Writings on Improvisation and Composition

by Jim Hearon

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...ON COMPOSING AN IMPROVISATIONAL SCORE

Notation has evolved to a point of being free enough to delineate almost any activity in music today. Verbal scores, graphic notation, indeterminacy, proportional notation, rahmen notation and various other techniques of using the printed page for a set of directions have opened the realm of the composer to include the domain of the improvisor.

The arguments for and against the composer's art could be waged again and again. There are some who think the last contemporary composer ceased to exist in the early 1970's. Others try to openly advocate the existence of the composer by constantly performing new composers works on their programs. The improvisational score may lie somewhere between the two camps, and thus be a valid point of departure for both extremes.

The best improvisational score admits of nothing in particular and yet obtains a predictable result almost invariably. This new type of score may not look at all like the traditional score with music staff lines, rhythmic meter, instrumentation, expression marks, tempo indications and the like. The new score may look more like a game, a puzzle, a picture, or even a poem. It might be a blank piece of paper with an indication to the performer: "improvise freely".

There are several devices which act in various ways in any musical score to form a work of art. An item such as the directive is almost an imperative in notation where aspects of making music are left to the discretion of the performer. Some type of direction is needed to indicate to the performer what is being communicated. Directions such as PLAY THIS FIRST, PROCEED TO LETTER B, REPEAT AND FADE, or IMPROVISE FREELY FOR 25 SECONDS are common in an improvisational score.

Another aspect of music which provides interest for the listener is the combination of unity and variety. Shaping the outcome of the music in a score to achieve for example a dynamic structure versus a static one is an area which some improvisors consider encroaching upon their creativity. This particularly "gray" area of composing a gesture but non-specification of the content of units or variations thereof is one item which helps distinguish an improvisational score from a more traditional score.

The improvisor's art needs total and absolute freedom in order to exist in an altogether different spiritual realm from the bound systems of composers' music. Yet the improvisational score may be interposed between the spontaneous creative act and its translation into sound by being regarded as a source for inspiration, stimulation, or reference in areas such as the implicit designs of an underlying musical structure. The act of ordering the structure of the music prior to performance can be considered directly analogous to other types of organizational procedures such as the editing of a tape of a live improvisation after the performance. Most improvisors interested in achieving a truly new structure in music have thought about this aspect of their music in some way or another. Unity and variety are the elements which are involved in the achievement of musical form--new or old.

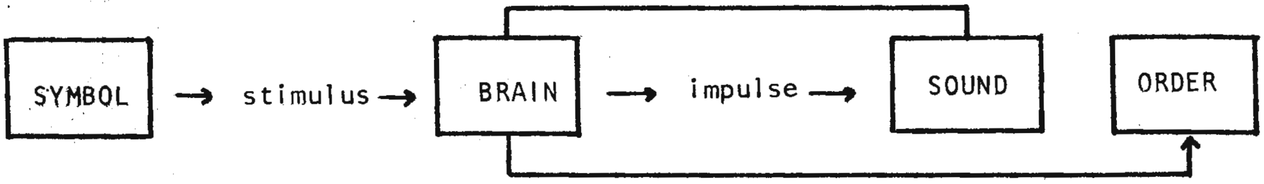
The symbol is perhaps one of the most important developments in an improvisational score. The symbol represents concepts and ideas. The composer today has many symbols of musical notation at his or her disposal. The various styles of notation range from the more to the less specific. A page from a score by Richard Wagner with all the accompanying tempo, dynamic, phrase, articulation, bowing, and expressive markings etc. strives to yield one particular result. A symbol of a guitar combined with a screwdriver however has the possibility of quite a variety of different sounds. In fact, Wagner's set of symbols could be quite cumbersome in trying to represent the sounds of the later mentioned objects.

Graphic notation is one type of notation which does not presuppose the tools used to produce the sound. The graphic representation of sound requires organic optical comprehension in order to biologically compute the information being communicated and is thus a step between Wagner's set of musical symbols and the pictorial representation of the guitar and the screwdriver.

The syntax of the symbols used in an improvisational score should always strive to stimulate creativity in the performer. Symbols which allow alternative interpretations and consequently results will be the ones most appropriate for an improvisational score.

One thing all musical symbols have in common is that they do not possess the properties of the entities they represent. The symbol itself does not have the same properties as the sound it represents. Thus an improvisational score or any musical score for that matter, is not music. A score is merely representative of sound and in so doing it makes a statement about the ordering of sound and silence in time.

The ordering of sound and silence in time presupposes the shaping of music as something extant in the environment coming after the organism and the sound producing medium. The model below shows the relationships between symbol as stimulus, brain as information processor, sound as impulse, and the ordering of time as a resultant of sound.



It is important to say that not everyone would have approached this subject in the same way or even have followed the same procedures. Experimental music which provides a predictable result within a certain framework, can be as valid a work of art as a more traditional and specifically notated composition. The improvisational score makes a stand between complete unorganization on the one hand, and absolute control on the other, and it provides a strong advocacy for both the composer and the improvisor.

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COMPOSITION AND IMPROVISATION

by James Hearon

The musical composition is a work of art which when completed by the composer allows for performance again and again with a minimum of deviation from the original design. At the beginning of a musical composition a performer begins to play the music according to the notation of the meter, tempo, expression, dynamic, phrasing, and articulation markings as well as any other directions such as the part of the bow, indications for fingerings etc. provided by the composer and/or musical editor. Improvisation, unlike composition, utilizes spontaneity and immediacy in its creation and repeated performances normally yield radically different creations which may have little in common with each other.

One of the fundamental differences between composition and improvisation is that the composer continually rejects possible solutions until he finds the one which best suits his purpose. The improviser, however, must accept the first solution that comes to hand (Sloboda 1985a). While composers may indeed improvise a solution to a compositional problem, a definitive compositional version is the goal of the decision making process which might involve improvisation. In live improvisation, however, the decision making process becomes more instinctive. Musical structure and form in improvisation, for example, are not perceived by the performer as exponential functions because the performer, in improvisation, is primarily concerned with his or her musical materials as they exist at that moment in time only.

Although the term improvisation is used to indicate the manner of music making within a variety of styles (popular music, jazz, blues, figured bass, indeterminacy, etc.), the term improvisation implies contemporary new music improvisation where contemporary new music (composed music) and contemporary improvisation performances have come to have much in common. The terms 'idiomatic' and 'non-idiomatic' have been used to describe the difference between the widely used styles such as jazz, popular music or baroque and the other so called 'free' improvisation styles (Bailey 1980a). Thus musical materials for new music improvisation may include non-traditional instrument techniques, kinetic performance, live electronics, text pieces, games, or any number of new music practices where traditional musical notation is not always utmost in the mind of the improviser.

There are several questions one may pose to test the hypothesis concerning the difference between improvisation and composition. One question which can repeatedly be asked when considering the difference between composition and improvisation is could anything have been done differently? Another question to pose which represents the natural consequence of the above question is if something had been done differently, would the result still have been the same?

In terms of compositional thinking, it is important that a decision be made regarding the composer's choice of musical materials. In a composition, choices made by the composer reflect in the microcosim the macrocosim of the composition. The inevitable selection of a motive, phrase or musical gesture by the composer as representative of important musical material begins the long unwinding spiral of the implications of this gesture and its meaning is made more or less profound by the composer's deft handling of his choice of those materials. Thus one point of view is that while there are new motives, themes, harmonies and textures, there are no new forms. In this sense the composer is said to be working with 'set forms' or frames which are filled with new musical material.

In improvisation, especially in a folk music context, set works may be performed again and again with variation applied to achieve an improvisational structure. For example the gypsies of central Europe used a set of text lines known to them in an improvisational way. The length of an individual song depended on what sort of mood the performer was in at the time and what lines happened to come into the performer's mind (Sárosi 1978). It appears there also may be a sort of 'frame' within which improvisation takes place, which dictates the large scale structure of a performance. If this frame remains the same over many improvisations, as in folk music, the performer is able to build up a repertoire of ideas which have worked well in the past (Sloboda 1985b). An interesting analogy with improvisation in music is the story teller, in the oral tradition, who uses familiar 'frames' with stock characters, plots, and episodes which can be varied each time according to different details (Sloboda 1985c). The above mentioned process of providing new material for an existing 'frame' is actually a type of synthesis from an existing model. The synthesis in this case is distinct from variation form but may be seen as a type of "master plan" or schema to be completed using variation details.

This procedure stands in direct contrast to the purely intuitive approach to making music which tap's the composer and improviser's inner world of musical subconsciousness. The composer uses, for example, his orchestration as an instrument of expression upon which is performed the inner world of subconscious dreams, desires, wishes, and emotions. For the improviser, however, dreams and desires are made real and placed in the physical world almost at the same time as they are conceived.

In live improvisation the effect of the audience's approval or disapproval is immediate and therefore is a crucial factor in the process of making music (Bailey 1980b). To some extent improvisers mimic and mirror the mood of the audience and the sum total of positive or negative emotions can influence the outcome of a performance. In this regard the compositional movement called Indeterminacy is similar to improvisation where choices are left to the composer, the performer, or the composer and the performer (Cope 1981) and audience participation can become an important ingredient of the musical experience.

Change is the very nature of improvisation. New developments are often combined with experimentalism to produce new ideas. Structural design in improvisation, for example, is often multivarious, sometimes purposely ambiguous, and may require a referential context to acquire real meaning. Structural elements may be rejected or verified before our very ears while a solution to the overall plan is being determined. Seasoned improvisers can continue to perform while exercising judgment at the same time as to the value of their musical ideas much like the composer shapes a musical theme until the potential exists for development.

Occasionally the difference between improvisation and composition is not clearly defined for the audience. If a performer, for example in popular music, has improvised a musical passage which is of compositional stature, then the listener may not know for certain wheather the performer has improvised the music, is reading the music from a manuscript, or is playing from memory unless there are visual cues which tell something about the performance. The difference between composition and improvisation, in this case, might best be described as a difference of state of mind. While the performer may have improvised music which sounds composed is relatively unimportant. It is critical to note, however, that the performer was "making the music up" as he or she performed. Another way of saying this is that the music was composed at the same time as it was performed. A workable definition of improvisation states that improvisation is composition without forethought, with considerations for style (Zierolf 1982).

There are various methods of organizing control in improvised music. In Baroque music the basso continuo was given as melody and bass lines together with a configuration of the basic harmony. Thus the performer had the freedom to choose the harmonic texture but had to remain within the chordal structure of the figured bass. Modern jazz from the late 1950's onward tended to go for the use of harmonic progression as the basis for group improvisation. The first section of the piece, called the 'head' was usually a melody played over a familiar chord progression after which followed a vamp section with free extrapolations of the original idea before a return to the 'head' and the rather straightforward harmonies. Improvisation is an indigenous element also in blues, popular, and rock music in the solo or vamp section where the basic chord progression provides harmonic support and helps define the limits of the solo section.

While there may be only slight if perceptible differences between a composed performance and an improvised performance of a similar style of music, one is almost certain to be able to make observations concerning the nature of the musical performance. Improvised music which appears composed and banal is usually not considered very unique or original. Any number of musicians can easily whistle a tune which is considered "made up" or improvised. In reality, however, these serendipitous compliations are variations based on exisiting musical structures which are embedded in the subconscious memory awaiting recall. John Sloboda asserts that the fundamental basis for musical memory is the ability to extract higher-order structure from a sequence of notes. He maintains that in an oral context, the musician uses a stored structure to generate different, but structurally linked, note sequences on different occasions. That ability becomes what we know as improvisation when placed in a literate context (Sloboda 1985d).

Improvisation which begins in the spirit of advancing to a higher level of structural organization can be employed for more precise compositional aims. What the improviser plays is of great importance to the composer. While a large part of improvising techniques are developed to meet particular situations encountered in performance, some practical situations imply other hypothetical situations, and so one device might be developed to cover a wide range of possibilities (Bailey 1980c). Still another area where improvisation and composition come together is experimentation for the sake of obtaining data and feedback.

On computer music synthesis systems which lack adequate real time performance capability there is a great amount of trial and error experimentation which takes place in order to become familiar with the sounds being produced. While some composers may be able to sit down and type in a piece straightaway, most people need feedback before a complete composition can be programmed effectively. Although the goal in theory is to develop an ability to predict desired results, trial and error experimentation is remarkably similar at the onset to improvisation. The composer, however, has the opportunity to refine his results through the reduction of errors until the desired effect is achieved. The live improviser must accept experimental results, for the moment, and continue to press onward using those results as stimulus for the creation of similar data.

In improvisation, musical decision-making is much more immediate than it is for the composer. Although many snap judgments are made, some kind of control is necessary. Improvisers often work in terms of rather loosely defined "shapes," which can be defined in terms of characteristics or parameters of music such as volume, pitch, duration, rhythm, pattern-finding, and silence (Roads

1985a). The improviser's reaction to musical parameters such as pitch, rhythm, duration, pattern finding etc. are required in immediate responses which in turn generate new stimuli and still more responses until the total improvisation evolves into a significant work shaped by the stimuli and responses which act as lower-level structural determinants. Thus improvisers, like composers working with the computer, make musical choices based on the familiar parameters of musical ordering and structuring.

The differences between composer and improviser need not become categorical boundaries. Each should influence the other. Especially today with the rapid rise in the number of composer/performers, improvisation plays an ever more active role in the shape of musical composition. Consequently the modern composer has become influenced by activity among improvisers regarding new methods of structuring, interesting new sounds, advanced ideas of how to integrate scores with improvisation, extended notions of what an "instrument" is, and what a "virtuoso" is (Roads 1985b). Still some composers dislike the idea of relinquishing control over the music by relegating decisions to performers who in turn become composers. Yet improvisation makes a strong statement concerning the performer's ability to organize musical structure just as effectively as the composer.

There are also many parallels regarding improvisation and linguistics, human communciation, strategies for behavior, adaptivity, role playing, and games. While these fields provide effective analogies to help explain the musical activity involved in improvisation, people are learning more today about improvisation simply through the human interactions involved in making music. Thus there is a need to define improvisational practices more carefully through the use of protocols which will help clarify procedures which have worked well in the past. Hence compositional solution-generating and verifying processes which involve heuristics may be of benefit in determining effective improvisational procedures. Thus there are many constructive ways composers and improvisers can help each other in reciperocal collaborations. If a truly effective method for producing music spontaneously, through the practices of composition and improvisation, can be discovered, it may well change the way we think about music.

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STRUCTURAL DESIGN IN IMPROVISATION

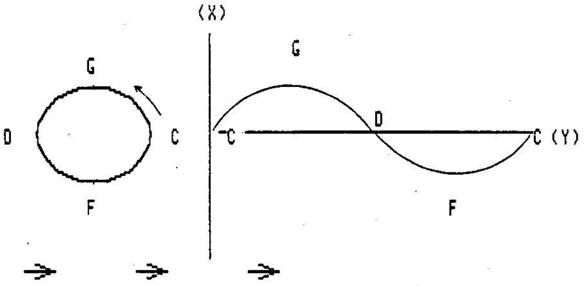
by Jim Hearon

Musical structure is often a difficult concept to appreciate because it is an aspect of music which is theoretical and abstract. Nevertheless an awareness of structural functions can help make us more aware of how musical gestures contribute to the creation and design of musical structure.

An appropriate analogy to help understand the concept of structure versus form in music is one in which musical form is compared to an architect's drawing of a plan for a new building. Imagine the overhead view of this plan with its various rooms and offices and you have a good example of musical form. The structure of a piece of music, however, when compared to the concept of a new building, would be represented by three blocks, one on top of the other. The bottom block represents solid ground, the middle block represents the foundation, and the upper most block is the actual building. Thus structure is a relatively abstract concept.

The structure of a large amount of tonal music is based in part on the alternation of harmonies between the tonic (I), subdominant (IV), and Dominant (V) chords of a particular key. Heinrich Schenker, Felix Salzer, Gerald Warfield, and others (see below) have written a great deal about this subject.

A simple sine wave shape is given below (ex. 1) in order to understand the structural functions of tonic, subdominant, and dominant harmony.



Ex.1 *Sine wave shape resulting from tonic, dominant, & subdominant harmonic movement.*

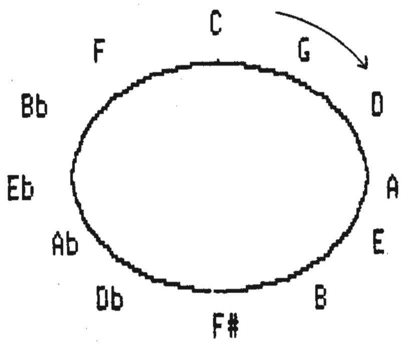
Imagine the pitch wheel on the left turning counterclockwise from tonic (C), thru the dominant (G), around to the subdominat (F), and back to the tonic (C). The periodic shape of the sine wave results from a stationary point on the wheel tracing the motion from tonic to dominant and subdominant as the wheel moves forward in time.

For more information on the structural importance of primary harmonies, see the following works:

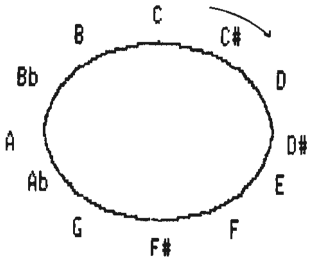
Felix Salzer. *Structural Hearing: Tonal Coherence in Music.* (New York: Dover, 1962) 2 vols.

Heinrich Schenker. *Der Freie Satz.* Rev. ed. (Vienna: Universal Edition, 1956)

There are many standard cycles in the language of traditional pitch vocabulary. The most common representations of these cycles are known as the circle of fifths (ex.2) and the chromatic scale (ex.3).

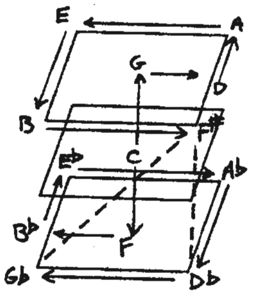


Ex.2 *Circle of fifths.*



Ex.3 *Chromatic Scale.*

While the above cycles lend themselves to a linear or two dimensional presentation, structural functions in traditional music can also be represented in three dimensional space. The following diagram illustrates tonic, dominant, and subdominant functions as separate, hierarchical planes (ex. 4). In this case, tonic is shown in a solitary plane, while the dominant and subdominant are placed in parallel planes, above and below the tonic, with respective closely related keys associated in the same plane. This system could be transposed to indicate a new tonic area.



Ex.4 *Three dimensional representation of tonic, dominant, and subdominant with related keys.*

Heinrich Schenker. *Five Graphic Music Analyses.* (New York: Dover Publications, 1969)

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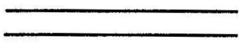
Structural diagrams for improvisation which uses non traditional musical language are more complex than those indicated above. Because new music improvisations often do not use traditional tonal relationships, the structural diagrams below simply indicate characteristics of the multivarious structural components common in improvisation.

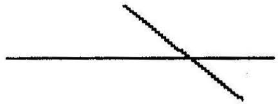
In addition, improvised pieces are frequently the result of spontaneous collaborations by several musicians. Often independant polyphony results when two or more performers are active in concert yet they pursue altogether contrasting planes of musical creativity. Moreover the idea of through composed form usually pervades the musical structure of improvised music as well. Thus in order to visualize structural functions, a reduction of elements to essentials is necessary.

The example below (ex. 5) indicates that for two or more improvisers parallel structure sometimes results. The lines may or may not be in the same plane. This example indicates the case where improvisors perform in separate spheres of creative activity which are closely (same plane) or distantly (opposite plane) related.



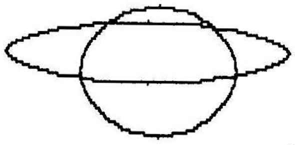
Ex. 5 *Parallel structure.*

Another type of structure achieved by more than one improvisor is the intersection (ex.6). The lines are always in the same plane at the point of intersection. This diagram could be redrawn to include all angles thus yielding designs such as squares, triangles, etc. Here the improvisors breifly merge, at some point, and focus on a unity or similarity of structural elements.



Ex. 6 *Intersecting structure.*

A circular shape is rare in free improvisation. Yet when cyclic design is achieved it usually is intended to indicate having reached the point of beginning, rather than actual repetition. The spherical shape below (ex. 7) is interesting because it contains within it possibilities for parallel, intersecting, and oblique planes.



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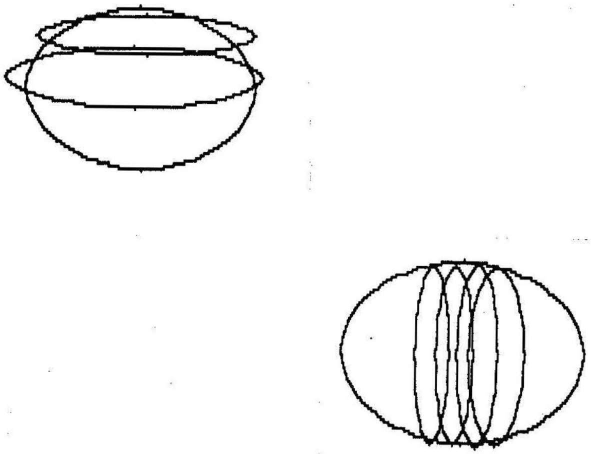
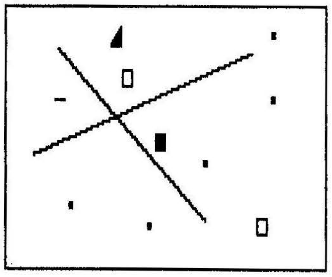


Ex. 7 *Circular structures with parallel and oblique planes.*

Finally some structures are intended to be ambiguous. A referential structure which acquires meaning only thru association in another context can be labeled alternately genesis or dissolution (ex 8).



Ex. 8 *Genesis or dissolution of structure.*

While improvisation strives to contrast with composition in many domains, careful consideration must be given to avoid a redundancy of structure. As improvisors develop new musical materials and build a syntax and grammar to shape new languages, structural functions remain the most important factor in delineating a new from an old style. Structural design is not always achieved implicitly thru conscious activity. Nevertheless awareness of design in musical structure will assist in the creation of more meaningful and lasting works of art.

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emotion in improvisation

Jim Hearon

Emotion, in a musical work of art, is whatever the listener perceives as being suggestive of various states of feeling brought about by the excitement of those feelings thru empathy and self-association of personal experiences with a particular pattern of musical sounds. The emotions stirred within each individual's physiology by a particular succession of musical pitches are unique to that individual. Although universal concepts, hence terms, may exist to adequately express various types of human emotions, the particular self-references of experiences which conjure up broad emotions, such as sadness, joy, grief, pain, etc. are all unique and individual experiences. While emotional states of feeling brought about by listening to a particular piece of music may be expressed in universal terms, the individual and personal experiences by which each individual refers to those terms are unique.

While a majority of popular opinion may indicate that a particular piece of music is perceived as uplifting and joyous or by contrast, sad and foreboding, it is not likely that the experiences each individual associates with those emotions would be the same. Hence music has different meanings for each individual and evokes particular memories, stories, dreams, and events which are related to the personal experiences associated with certain broad emotions felt or perceived while listening to a particular piece of music. The degrees to which broad emotions are felt more or less strongly while listening to music are undoubtedly influenced by many variable factors surrounding a performance such as changing external stimuli, environments, time, and technology. Ultimately, however, the relation of particular experiences, thus feelings, with broad emotions associated with a particular musical work can become a learned experience through repetition, education, or mimicry. When one associates a particular emotion with a certain musical work, it is hard not to feel the same way each time the piece is heard.

Does the performer impart emotional messages in the music which are communicated to the audience? Does the performer, in fact, and not the composer, improvisor, or arranger, transmit broad emotional states of feeling to the audience? Is emotionalism, perceived by a listener, simply empathy with the performer's states of feeling? These are important questions which lead to conclusions implying that music has a higher order of meaning which is defined and explained with a specific system and language. The language is theoretical and abstract but nevertheless explains with specific analytical systems and terms why music is perceived as representative of certain emotions.

Certainly performers, through tradition and training, come to a consensus of emotional effects achieved by playing certain works. Thus it is normal that performers and audience members alike experience the same emotion from a piece of music. If the performer is a highly expressive player, and one who exaggerates the emotional content of the music effusively, then there is likely no ambiguity at all concerning the intended emotion to be associated with the performance of a particular work. What if a performer is a more technically oriented one, and eschews an overt display of emotion during a performance, favoring instead a more inward and intellectual approach to performance? In this instance, the music must "speak for itself", and the succession of musical notes played with the exact tempo, articulation, dynamics, phrasing, and expression indicated by the composer will be indicative of a particular emotion, independent of whatever mood or feelings the emotionally subdued performer may have at the time.

In music improvisation, where musical parameters such as pitches, dynamics, articulation, tempo, phrasing, expression, register, rhythm, etc. are shaped at the instant they are created, it would be difficult to predict what the emotional message communicated by a passage of improvised music is going to be. Rather the feelings associated with improvised music, which is truly spontaneous, immediate, and original, are perceived "ex post facto", or after the fact, albeit almost immediately. This is not the same with jazz, primitive folk music improvisation, or other types of improvisation which can be developed through variation and repetition where the messages and content associated with particular patterns can be learned and repeated by performers who emote the learned feelings as they play.

In a truly unique situation for improvisation, the particular mood or feelings of the performer, such as anger, fear, frustration, joy, happiness, etc., ideally should have no external influence upon the messages communicated within specific passages of music. At times, however, the emotions associated with the music being produced, may coincidentally be the result of vicarious influences of personal feelings of the performer. This purely musical approach to the explanation of perception of emotional content in music relies instead upon the musical language of theory and analysis to explain why the juxtaposition of musical events evoke certain emotional responses.

How can emotional responses be predicted and recreated in improvised music? For improvisors, the recreation of events which lead to specific emotional responses, is sometimes desirable. Film and Video are mediums which use emotional music to underscore the dramatic content of the action in a particular scene. While the music might change, the drama is essentially the same each time. The use of other mediums to help control emotional responses is one way of predicting similar results. Lights, visual arts (slides, paintings, photos, sets), and special effects are mediums which contribute to the perception and association of emotional states with music.

For musicians, the score remains the best means to organize music into predictable results. The score may be more or less rigidly fixed in terms of exact musical details. What if, for example, the score calls for a span of ten seconds of free improvisation "to be played angrily", within the framework of the music? Will this passage always be perceived as "angry music"? It is quite possible that the "angry section" could be perceived as having associated with it instead kind and gentle emotions such as calmness and serenity. In order to recreate similar emotional responses it may be necessary to further understand what types of musical events bring about the perception of music as sounding "angry". More musical descriptions, without destroying the improvisation framework, can improve upon the score. For example, keyboard instrument: play loud, low range, dissonant intervals, active rhythms, staccato, in a fast tempo. These descriptions combined with the inscription "play angrily" would most likely yield the desired musical result, yet allow the performer the freedom to make specific decisions.

In terms of musical style, the type of performer indeterminacy described above can be considered encroaching upon the absolutely free improvisor's territory. The free improvisor is also an instantaneous composer, and may not feel the need to predict emotions associated with musical events. The emotional content of this music is also indeterminate and improvisatory. In this case, heuristics or exploratory learning might prove beneficial. Quite simply talking to audience members after a concert in order to help measure responses, or listening to a recording of the performance with others and discussing the responses might provide insight into the perception of emotion in this type of improvised music. It is a fallacy, however, to always think that the performer's emotional states and feelings are projected into the music to the extent that they influence the emotional events taking place, and thus the perception of those events as being associated with and matching the desired, projected, and perceived emotions which are represented by music.

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EXPERIMENTAL MUSIC: AN ACADEMIC APPROACH

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ABSTRACT

This article seeks to justify and explain experimental music in the classroom through a historical and chronological presentation of developments in that style of music making. The value of experimental music as a discipline for music students is also set forth in a logical and coherent manner, with references to learning in the experiential mode, theories concerning play, language, improvisation, the visual arts; and inner mechanisms such as dreams, telepathy, cybernetics, intuition, and instinct. Also included within the scope of the article are relevant comments regarding methods of evaluation for an experimental music course and concluding remarks concerning the future of contemporary music.

從學術觀點來看實驗音樂

内容摘要

這篇文章的宗旨是透過實驗音樂的歷史與其隨着時代的變化來分析這種音樂在課堂裡的應用。此外，本文作者亦會以極具邏輯性與清晰的方法來討論實驗音樂作爲一個學科的價值；討論範圍包括從實驗中培養學習，以及遊戲、語言、即席表演、繪畫藝術等理論。至於較爲抽象的内在因素如夢境、心靈感應、腦電波、直覺及本能等，亦會有詳細的探討。最後，作者會討論實驗音樂課程的評核方法及現代音樂的未來發展。

INTRODUCTION

In the field of music composition, experimentalism is an indigenous aspect of the growth, death, and rebirth of musical style. The twentieth century, without a doubt, is the period which has seen the most activity in the development and decline of musical style, hence new systems or approaches towards composition. Many students today learn their craft under a teaching system which has become outdated. Students first learn Harmony and Counterpoint along with Form and Analysis. Then they write compositions, first in the small forms such as inventions, sonatas, or art songs. They may gradually develop enough technique to compose a minuet and trio movement for string quartet, possibly a work for chorus, and may eventually compose a large work for orchestra. If the student is very ambitious and has sought a performance of his work, he may have learned something about realities of performance, and thus may have come to respect the performer's point of view. Unfortunately the student may graduate, having acquired compositional skills, without any understanding or mastery of contemporary compositional trends.

Music is by nature an abstract art. For the young composer, the opportunity to learn something tangible about music, to be able to experiment, to make value judgements about contemporary music, and to ascertain the importance of those experiments in relation to producing a work of art, is of extreme importance in the development of a strong academic background. Courses in experiential learning offer a sensible and practical solution for solving the problems encountered by students as they attempt to master the art of composition, especially contemporary music composition. Experiential learning can also provide an appropriate scientific and psychological rationale for musical experimentation without minimizing aspects of intuition, instinct, dreams, or ambiguity. Rather it allows those forces to work together in the arena of experimentation with the conscious decision making process.

A BRIEF HISTORY

Traditional approaches to experimentalism in the early twentieth century included works by Erik Satie, Claude Debussy, Richard Strauss, Alexander Scriabin, Arnold Schoenberg, Anton Webern, Igor Stravinsky, Béla Bartók, and Charles Ives who all worked within the rigorously controlled structures of the classical tradition. Musical experimentalism for these composers was a reconceptualization of musical materials, such as melody, harmony, rhythm, form, orchestration and texture, without sacrificing the ideal of achieving "beauty" in their compositions. The relativity of the term "beauty," however, is easily grasped by listening to such diverse compositions as Debussy's *L'Après-midi d'un faune* (1894), Stravinsky's *Le Sacre du printemps* (1913), or Webern's *Five Pieces for Orchestra, Op. 10* (1911-1913). By 1924 the serial composers, led by Arnold Schoenberg,

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had developed a compositional technique using a twelve-tone row as the basis for a composition. It was in the music of Schoenberg's pupil, Anton Webern, however, that later composers drew inspiration for a totally serialized approach to composition. The music of Pierre Boulez, Milton Babbitt, Karlheinz Stockhausen, Luigi Nono, Bruno Maderna, Luciano Berio, and other composers tended to organize rhythm, pitch, dynamics, texture, articulation, register, tempo, and even musical form according to dodecaphonic or serial principles.

While the experimental musical endeavors of the traditional composers have today largely become accepted, the works of the Avant Garde and Futurists are still seen as bizarre and strange. The Futurists, for example, sought to avoid music with the traditional approach to melody, harmony, instrumentation, counterpoint, rhythm, and form. Their music sought to avoid the harmonic spectrum of sound in favor of the enharmonic mode, which they believed contained intervals smaller than the semitone and made possible a maximum of determinable combinatorial sounds and novel relations of chords and timbres.[1]

The futurist orchestra of the early twentieth century consisted of a number of original instruments which were mechanical devices attached to a megaphone-like speaker. Called *intonarumori* ("noise-intoners"), these devices were capable of making sounds or noises in six main categories as defined by the chief inventor of the instruments, Luigi Russolo. Among the noises produced by the instruments were explosions, booms, whistles, murmurs, screams, screeches, shouts, shrieks, groans, howls, laughter, and many other sounds.[2] Russolo composed scores using non-traditional notation for the music which utilized the unusual instruments he designed and helped build.

The futurist movement began in Italy in 1909 under the direction of a poet, Filippo Tommaso Marinetti. In 1911, a composer who was also a member of the group, Francesco Balilla Pratella, published a manifesto on *Futurist Music* and in 1913 Luigi Russolo, a painter by profession, published his own manifesto entitled *The Art of Noises.* These pamphlets make interesting reading for those further interested in the early experiments of the futurists.[3]

The Avant Garde movement in music can be traced through the work of many leading composers in the early twentieth century. This collective group of international composers had openly questioned the fundamental principles of Western classical music and they also challenged the established traditions in music by the unusual nature of their musical language.[4] The American composer Henry Cowell gained notoriety in the 1920s and 1930s for his experiments using the inside of the piano to produce new and striking musical effects. Properly classified as part of the Avant Garde movement, Cowell published *New Music Resources* in 1930 documenting his work. *The Banshee* (1925), one of Cowell's best compositions for the piano, required two performers (one to hold down the pedal) and involved plucking and stroking the strings inside the piano.[5] Another member of the Avant Garde was the European composer Edgard Varèse who worked with electronic music. His *Poème Électronique*, written in 1958, contains voice moans, church bell tolls, thunder, the sounds of jet aircraft, and many other natural sounds. Varèse utilized the tape recorder to capture and manipulate natural sounds using classical electronic music studio techniques (cutting, splicing, changing speeds, etc.) Properly called "Musique Concrète," this example is a mixture of natural sounds and pure electronic music. Varèse composed this work at the Philips Studio in Eindhaven, the Netherlands, during the so called "studio age" of electronic music. It was ultimately performed in a pavilion which contained over 400 loudspeakers desiged by the architect Le Corbusier for the Brussels World's Fair in 1958.[6]

The American composer Harry Partch focused attention on the importance of the composition, study, and performance of microtonal music. His book *Genesis of a New Music* (1949), outlines in detail a history of microtonal developments from the ancient Greeks to the present, and includes descriptions and photographs of the many unusual instruments he constructed for performances of his music. Recordings of his works are still available. Two of Partch's best recordings are *And on the Seventh Day Petals Fell in Petaluma* and *Delusion of the Fury*.[7]

John Cage, also an American composer, developed a method of composition employing chance operations. This type of compositional approach called *Indeterminacy*, has had an enormous effect upon a new generation of composers by furnishing a viable alternative to the methods of organization employed by the serial composers. One of Cage's most famous compositions *4'33"* (1952), is an extreme example of what Michael Nyman calls composing by "process" or composing the "situation" around the composition. In this piece, Cage asks the performer to sit on stage without making a sound for the duration specified. Thus the sounds presented are those which exist in nature and also those realized unintentionally by the audience. Cage's music covers a wide range of experimental techniques including studies for prepared piano, live electronic music, dance, and mixed media.[8]

The revolution in sound has had an equally important effect upon musical notation. While composers such as Morton Feldman, Christian Wolff, and Earle Brown have continued to use Indeterminacy, many other composers have developed new notational procedures. Roman Haubenstock-Ramati's *Mobile for Shakespeare* (1968), incorporates elements of free choice in a new visual and structural form called the "mobile." Several composers have worked with instrument exploration techniques in order to develop a greater variety of tone colors available from the traditional orchestral instruments. Krzystof Penderecki's *Threnody for the Victims of Hiroshima* (1960), written for a string orchestra of 52 performers, employs dense microtonal chord clusters written in proportional notation. Many types of notational systems have evolved in contemporary music including graphic, proportional, symbolic, rahmen notation, prose scores, and idiomatic notation. One example of idiomatic notation would be a computer program for the generation of sound. Several composers have been active in using new notational systems as a compositional procedure. Among those are Witold Lutoslawski, Mauricio Kagel, George Crumb, Peter Maxwell Davies, and Györy Ligeti.[9]

The new experimentalism led by Terry Riley, Steve Reich, and Phil Glass, has brought about a surprising return to tonality, triadic chordal structures, simple rhythms, and the use of repetitive melodic ostinatos. This music, called "process music," presents a clearly defined audible process – such as the addition of notes, subtraction of notes, phasing or cross-fading of melodic cells, use of palindrome, and numerous repetitions of various ostinatos – as the method of compositional organization. Steve Reich's *Music for Mallet Instruments, Voices, and Organ* (1973) presents simple repetitive patterns which become gradually longer in duration until they reach a maximum of length. The patterns then contract slowly and return once again to their original durations. The form of this piece is like an arch form or a palindrome composed of several smaller palindromes. While the static quality of "process music" has not proven popular with many musicians, composers who have been influenced by this style of music are numerous. Among the most famous are Brian Eno, Toshi Ichiyanagi, and Stephen Sondheim.

Finally, music improvisation is a very important aspect of recent trends in experimental music making. Modern improvisation has gained inspiration from a variety of sources. Emphasis at this time is no longer on melody or a lyrical quality, but rather on achieving the unexpected in both dimensions – the vertical and horizontal. The destruction long ago of the traditional syntax of musical language, in terms of musical design, has led to new relationships based in some degree on the principles of the visual arts. These compositional devices can, nevertheless, be interpreted organically. Composing for improvisation has yielded a methodology of symbology and a graphic description of sound. Also a syntax devoted to written directions has developed. Musical compositions for improvisation may be based on games or play theory, movement (eurhythmics), or inner mechanisms such as intuition; combined with visual arts (multi and mixed media); or provide reference for new musical forms. Improvisation is a healthy sign of a more open state of mind regarding contemporary music experimentalism.

EXPERIMENTAL MUSIC AS DISCIPLINE: RATIONALE

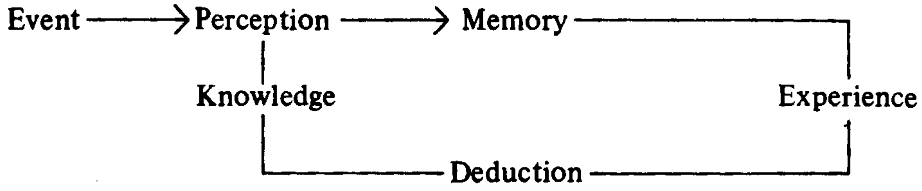
The experiential learning approach to academic curriculum can be extremely beneficial and preferable to the traditional structure in many types of courses. If the student of experimental music is to gain a knowledge of the practical applications of his experiments, and make deductions concerning the consequences and utility of those actions, he must experience those concepts rather than assimilate them as information or academic facts.

The most common approach used in an academic curriculum is the lecture, tutorial or seminar where information is imparted. Conclusions may or may not be drawn, and deductions as well as the practical application to the conditions of everyday life are left for the student to discover for himself. This "transferal of information" process is, unfortunately, the most effective one in many course situations, for it can enormously reduce the amount of time required to learn something new.[10] The medium of instruction in other types of courses, however, such as experimental music, is not language or even a symbolic medium, and requires the experiential approach to insure that through a sequence of actions something, however abstract and unique it may be, has been learned.

We cannot measure exactly what each student learns in the experiential mode, for each person brings a whole set of prior experiences with him to the situation in question. It may be desirable not to attempt a realistic explanation of those ideas synthesized from experimental actions. The perception and memorization of concepts, moreover, should be the result of student initiative. Ideally, in the workship environment, any number of concepts or ideas can be grasped quickly and simultaneously, allowing knowledge of the subject to be understood immediately in its pure form. The experiential learning mode for experimental music has several beneficial points:

1. Insures action through experimentation. Students learn about contemporary music by composing and performing.
2. Stimulates and aids in the development of creativity.
3. Develops critical thinking. Students make decisions regarding the effectiveness of new music techniques.
4. Provides an alternative for those students who have been alienated from the traditional academic curriculum.

The stimulus or event on which the learning experience is focused should function as the "control" in the experiment. A careful presentation of the historical development of experimental music is necessary to produce sound technique. One method of experimentation is to perform a short original composition by a student several different ways. For example, altering parameters such as tempo, instrumentation, or addition or subtraction of a conductor will allow the student the opportunity to discover the effectiveness of a particular idea. It is a good practice to include feedback from fellow students at this point, and include their ideas as part of the experiment as well. The perceptions, memories, and experiences of the event are unique to each individual. The outcome, in terms of a creative project for those experiences, should be communicated in the same code or language in which they were originally received. That code is the symbology and syntax of modern music. A diagram of the experimental environment and its genesis into a perception-experience-knowledge loop is shown below.



COMPOSITION AND IMPROVISATION

The musical score is a collection of symbols which are not the sounds they represent. The score is representative of music only during a performance, but it continues to be a visual work of art long after the performance has ceased. In the past, the score was a definite set of symbols which allowed the performer to recreate an event with exactitude. Today the score is more plastic. In many cases the ambiguity caused by a lack of definition in the contemporary score, is exactly what contributes to the compositions' property of identity during each version of the performance. Contemporary improvisation performances and contemporary new music (composed music) have come to have much in common. Improvisation is the means whereby the composer is able to indicate schema, and leave the details to be "filled in" by the performers at a later time. Improvisation then engages the performer, who may also be the composer, for the spontaneous creation of music. It requires the performer to be involved with the music on a multitude of levels simultaneously: intuitive, technical, artistic, emotional, pragmatic, social, even political.

TASTE, HISTORY AND FAILED EXPERIMENTS

The Experiential approach to new music seeks to develop the decision making capacity in an experimental atmosphere. The workshop approach is designed to produce a substantive body of research or a portfolio of compositions rather than a corporeal body of abstract concepts. The "first hand" experience with new music techniques for performers and composers will facilitate familiarity with sounds which are usually considered strange, often funny, by audiences who are largely musically uneducated. Thus we seek to change attitudes, develop opinions, formulate theories, overcome prejudices, and develop taste by working with experimental music. In many colleges and universities today there is the equivalent of the contemporary music ensemble. These organizations which provide an alternative ensemble experience for performing students have, nevertheless, failed in the establishment of a truly productive course for providing an opportunity for musical experimentalism. While these ensembles do perform contermporary music, they do not offer the student a genuine opportunity to experiment with the various possibilities of his own compositions which are produced in the first place with regard for historical pastiche.

EXPERIMENTATION AS PROCESS

Several new and interesting techniques have evolved for making experimental music. These techniques are closely aligned with concepts relating to the theory of play, inner mechanisms, language and the visual arts. While traditional methods such as learning by rote, imitation, quotation, or historical pastiche still retain their effectiveness, these methods tend to produce results which are rather passé when compared to recent developments.

Language in its most simple definition is communication with sounds.[11] Music like language is composed of small units which when combined form the grammar and syntax of a code or dialect which has meaning within the context of that system. When we speak of a composition as "languaged," we mean the vocabulary, grammar, and syntax of that code have unique identity properties comparable to a different dialect of language or, depending upon the composition, an altogether different tongue. We might also have a composition which remains in a specific domain throughout. In other words, the music is an object language which makes no reference to additional systems. For a language which makes reference to the object language, such as grammar or sentence structure, we need a metalanguage, and consequently a metametalanguage to provide reference for the metalanguage and so on.[12] Unlike ordinary language, however, music can be abstract and still express meaning, probably because what we understand by the language of music not is expressed in terms of words but is an abstract intellectual cognition usually combined with emotion.

The development of facility with inner mechanisms can be taught in a number of ways. A movement popular a few years ago called cybernetics or biomusic, dealt with the interpolation of biological information, such as brain waves, directly into music. Experimental psychologists call such a technique immediate feedback. Improvisation is a good method used to develop instinct, reflexes, intuition, and creativity. Eurhythmics is another technique which produces an awareness for both inner and outer body experiences with rhythm. Also performing in small ensembles, without the aid of a conductor, produces a high level of communication which is related to telepathy. Good performers have highly developed neuromuscular skills as well as visual and aural senses.

Learning through games is an important form of experiential learning in which players learn adaptivity, develop a strategy, use their instincts, and make choices. Through games and play, students make use of symbols to form a link, a match, or act out events which are equivalent to situations present in the physical world. Play has an important relationship to imagination. Through the use of symbols students are able to codify experiences, store meaning, and create a symbology or syntax which is the basis of communication. Language and myth use word symbology, play uses a symbology of action, and dreams utilize a symbology of visual imagery. Play is an important first step in the growth process of real learning where sounds, which are the symbology of music, are transferred from the inner world of fantasy and imagination to the external realm of factual reality.[13]

THE AESTHETICS OF TECHNOLOGY

Musical applications of recent developments in computer technology have affected experimental music to a great extent. Computers are able to produce new information from what they have received, according to the manner in which they have been programmed. Because this process is analogous to the procedure which takes place in humans, we can say the computer has learned how to do something.[14] The term "artificial intelligence" has also been used to describe aspects of this phenomenon. It is important to consider the process of experimentation and to ponder the question of who is in charge. Is it the composer or the machine which is responsible for producing a unique result?

A frequent criticism of art produced by computers is the lack of emotion or any apparent human quality. The increased memory capabilities, storage capacity, potential for variation, and high degree of accuracy available with the computer are advantages, however, which are often overlooked. A potentially rewarding type of improvisation called computer assisted improvisation has been developed in which the computer is programmed to "listen" to a melody and respond either exactly or with random or controlled degrees of variation. Another area of experimentation using computers is digital sampling and sound synthesis to achieve sounds which are true to life. Many of the sounds used in radio, television, and film are now computer generated. Thus the computer has already become a part of the sounds we experience in life as we go about our daily activities.

RESULTS

The various experimental methods employed in the classroom have in common the production of creative activities concerning new music. The final experimental results should yield a high number of creative projects such as the production of compositions, performances of those works, development of creativity, and a change in attitudes concerning contemporary music.

The methods utilized to achieve results may be a combination of various approaches to experimentation, such as trial and error, empirical methods, gestalt, and true spontaneity. In trial and error experimentation the student literally tries out an idea, discovers the potential problems, and revises the composition accordingly for a second reading. Empirical methods employ a hypothesis and conditional statement. Deductions are usually formulated after initial testing of the hypothesis along with the elimination of erroneous information and the assimilation of facts. The student assumes a condition will be true given a particular situation or event and is given the opportunity to test that hypothesis. Gestaltists see the whole structure of music and their approach is to assemble linkages or connections between elements or musical segments in order to complete the whole. There should always be room for true spontaneity in the experimental methods used in the classroom. Many serendipitous discoveries of great significance have been made in this manner.[15]

EVALUATION

Approaches to measurement or evaluation of experiential learning courses include the student contract, written narrative, oral examination, non-credit approach, and presentation of a portfolio.[16] It is highly desirable that the system of rewards and punishments be discarded in experiential learning in order to facilitate the maximum of learning potential. The workshop approach to experimental music, once again, is designed to produce a substantive body of research or a portfolio of compositions rather than a corporeal body of abstract concepts. While the grade is important, the experimental actions of the students are more important. Therefore, the final grade should be composed of course content and not an examination. Finally, allowing students the option of choosing one of several methods of evaluation is also a fairer method of determining final grades.

CONCLUSION

The invaluable experiences gained from a "hands on" approach to experimental music will have a lasting effect upon the students who have participated in such a class. When students invest action, time, and energy in the production of contemporary music, whatever conclusions may be drawn concerning the experiments will be personal, real, and meaningful. Some students will be inspired to go forward as more perceptive and cognizant musicians; others may simply become more enlightened members of the audience at future concerts of experimental music. While the activities of experimental music intrinsically do not depend on audience response for success, a more sympathetic response from the audience can completely change the nature and the quality of performance. In many intuitive scores, for example, the performer is asked to act as the perceiver before making a choice which will influence the outcome of the composition.[17] More and more contemporary music moves away from the two dimensional concept of the proscenium arch where artist and audience are separated by a physical and mental curtain. Music, like life, is amorphous and changes organically, shaped by the social, economic, and political forces around us. Never should one make the mistake of thinking that music will advance no further. One must expect change and applaud new ideas.

Change does not mean lack of appreciation for the ideas of the past. The music of the past deserves careful study and repeated performances. Only through knowing the developments of the past can one make intelligent decisions regarding the future. Not everything that is new will be good. Once an idea has been presented it is no longer new, but it seeks via acceptance or rejection to exert its influence on the mainstream. New ideas eventually become old ones. Some ideas die and others are perpetuated. Still part of the problem the composer today faces is that music has made advances very rapidly which are akin to recent developments in science, medicine, and politics. While the public can accept advances in those fields, it cannot understand an advance of the same magnitude in the field of music. The world imparted to the listener through contemporary music is one at which he has not yet arrived in reality, and thus it makes no sense to him. Thus by continuing the existence of a framework for experiencing contemporary music and maintaining a vehicle for exploring its concepts, techniques, methods, processes and procedures, we can provide assurance that students will go into the future active, knowledgeable, and interested in experimental music.

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THE PASTICHE COMPOSITION BASED HARMONY CLASS

Pastiche style composition is writing compositions "in the style of" a major composer for the purpose of displaying a knowledge of harmony as demonstrated in a compositional medium. Students who learn the rules of harmony through the application of pastiche composition develop compositional skills which benefit them as teachers, performers, composers, historians, and arts administrators.

The most common form of theory that students encounter upon entering the tertiary institution in the British Educational System is a course in Harmony, which consists of instruction in chromatic harmony. The academic approaches to music theory are quite varied in the British System. Harmony and Counterpoint as well as History and Analysis are often combined into single subjects.[1] In some liberal arts curriculums the undergraduate or diploma course may simply consist of a general techniques course which contains harmony, counterpoint, analysis, and composition.[2]

The general degree or diploma course in Harmony is quite different in many respects from the American Theory course. Because American schools are so varied in their approaches to curriculum, the traditional harmony course still exists in a few colleges and universities. In general, however, American Theory aims at teaching a wide array of topics such as music fundamentals, harmony, voice-leading, counterpoint, analysis, history and literature, aural training and sight-singing, even elementary acoustics in a course which may contain up to three levels or sequences in the undergraduate curriculum. This approach is due in part to the fact that a large number of students entering universities to study music have had no previous background in theory. The typical high school band student may have been exposed to some theory, and these students are generally very bright especially with clefs and transposition. Students who play classical instruments such as strings or piano may or may not have had previous theory experience. Jazz and rock musicians, although gifted improvisors, also may not have had any traditional theory.

The requirement for an entrance examination in theory in the British System insures that students have some familiarity with the basic principles of theory which are presented as introductory concepts in the American course. Thus the opportunity exists for specialization in the British System during the first year, for example, regarding the teaching of harmony where there may be a concentration on chromatic harmony.

In the British System of higher education students are required to pass examinations called *A Level* exams before entering a chosen field in a tertiary institution. Depending upon the entrance requirements for the various institutions, students may be able to submit alternative tests or credentials in liu of the *A Level* exam, such as the Grade 8 A.T.C.L. or L.T.C.L. theory paper, or a pass on the London G.C.E. Level syllabus.

In music, the *A Level* exams include rigorous testing of performance, history, theory, composition, and literature. Thus all music students normally have a firm foundation in music theory before beginning tertiary studies. The testing requirements are normally met by the teaching of music theory in the lower forms. Students may sit for the *A Level* with the appropriate qualifications normally after form 5, which is roughly equivalent to the American High School senior year.

Students are assured of having been exposed to the fundamental concepts in music theory normally before reaching the *A Level* exam. Concepts of music fundamentals such as rhythm, key signatures, major and minor scales, chord spelling and voice leading are fundamental concepts which are presented methodically through the 8 levels of the *Rudiments and Theory of Music* by the Associated Board of the Royal Schools of Music.[4]

Grade I, for example, consists of primary or introductory concepts such as the staff and clefs, sharps and flats, rhythmic values and rests, meter signatures, and musical terms. Grade 8 or final, contains dominant harmony, modulation, figured bass of diatonic harmony, two-part writing, writing a melody to given words, analysis of rhythmic structure, and harmonic analysis.

There are several differences, of course, between the British and American systems (as there are between the British and other European countries, for ex. Germany) such as the labeling of various rhythms (semibreve, minim, crotchet, quaver, etc.), the use of scale degree names for chord recognition instead of functional roman numerals (tonic, supertonic, mediant, etc.), and a general avoidance of the concept of secondary dominants and sevenths (tonicization) in favor of the diatonic chord name with chromatic alterations (II#3 for V/V).[5]

In an excellent *A Level* preparatory course chromatic harmony may have been presented, thus the tertiary course can begin straightaway with a review of those harmonies before continuing with pastiche style composition. Harmony courses based on pastiche style composition offer an effective alternative solution to the general teaching of the origin, theory, and rules of voice-leading for chromatic harmony. Hence students are assumed to be familiar with the academic part writing rules for S-A-T-B figured bass style writing before beginning tertiary studies in music.

The contents of a typical Harmony syllabus might list composition in Classical piano solo writing, Classical string quartet writing, Romantic song accompaniment writing, instrumental solo and accompaniment writing, and the setting of words to music for choir--both accompanied and acapella. Students demonstrate an appropriate understanding of the principles of chromatic harmony through their compositions which are written "in the style of" one of the leading composers in the generas listed above. Teaching materials for the class may include Classical sonatas and piano pieces by Clementi, Haydn, and Mozart, string quartets by Haydn and Mozart, Schubert's songs, Schumann's works for solo voice and for choir, Brahm's works for solo voice and for choir, Wolf's songs, Strauss's songs, and Berlioz's choral music.

Normally the harmony class consists of a lecture and a tutorial. The British concept of the tutorial is somewhat like the American music theory lab, where small group tuition is given for the benefit of the students enrolled in the class. Lectures generally include analysis, review of rules for the treatment of dissonances in chromatic harmony, instruction in the resolution of harmonies, and most important, instruction in pastiche composition.

The analysis employed in the harmony class is frequently a functional harmonic analysis with an identification of non-harmonic tones, as well as an indication of the formal characteristics such as phrase and period construction, thematic complexes, and major sectional divisions of the piece. Rarely does analysis include a detailed structural analysis. However a great deal of analysis is undertaken for the purpose of a better understanding of the composer's compositional procedure.

Lectures also include compositional instruction. One effective teaching tool is the use of classroom based quodlibet composition, where one student composes a few measures at the board followed by another student etc. Although many first year students do not intend to major in composition, the pastiche style composition approach to harmony benefits all students wheather they plan to become teachers, performers, composers, historians, or administrators. A sample checklist for compositional quidelines to instrumental solo and accompaniment writing is given below:

Considerations for Instrumental Solo and Accompaniment Writing

Solo Line:

1. Construction of a Theme.
    - a. melodic shape
    - b. phrasing
    - c. tonal characteristics
2. Motives.
    - a. short, concise
    - b. fragments
    - c. stable harmonically
3. Lyric Melody.
    - a. tuneful, singing passages
    - b. solfege
    - c. for instruments range should be larger than vocal tessitura.
4. Technical Passages.
    - a. arpeggios
    - b. scales
    - c. broken 3rds, 6ths, and octaves
    - d. melodic 3rds, 6ths, and octaves
5. Sequence.
6. Transposition.
7. Idiomatic Considerations.
    - a. strings-pizzicato, tremelo, trills, etc.
8. Notation.
    - a. tempo and expression markings, phrasing, dynamics, articulation, fingerings, and bowings, etc.

Accompaniment:

1. Instrumentation.
    - a. use piano, strings, guitar, harpsichord, organ, or orchestral reduction.
2. Texture.
    - a. melody & accompaniment
    - b. counterpoint
    - c. homophonic
    - d. accompaniment patterns
    - e. use of themes & motives
3. Harmony.
    - a. supportive of solo line
    - b. harmonic rhythm
    - c. diatonic and chromatic harmony
    - d. modulations
    - e. chord voicings

4. Notation.
    a. tempo and expression markings, phrasing, dynamics, articulation, fingers, bowings, etc.

Style:

1. Composition
    a. short piece such as a *Romance, Fantasy, Widmung, or Stücke.*
2. Form
    a. use one or two themes and/or motives plus technical passages.
    b. use simple forms such as ABA, AAB, AB.

Method:

Sketch a few measure of the solo line first. Combine solo line ideas with basic harmony. Use roman numerals to indicate harmonies, at first, creating texture afterwards from revisions, or using improvisation. Compose a few bars of solo and accompaniment texture altogether, moving forward with the piece a little at a time, always keeping the harmony clear.

Student's compositions are graded for musical content as well as the appropriate handling of chromatic harmonies. All compositions must contain correct instrument transpositions, proper tessituras, bowings, fingerings, phrasing, dynamics, articulation, tempo and expression markings, meter signatures, and key signatures. A useful instructional exercise is to have several of the better compositions performed in class to provide feedback for the students.

The final grade can be based upon combination of pastiche style compositions, together with mid-term, and final examinations. It is not uncommon to offer a three-hour final examination based on three or four questions which are quite challenging for the students. Mid-term and final exams usually contain harmonic analysis and pastiche style composition.

The pastiche based harmony class differs from American music theory in that the students have more facility and experience with chromatic harmony in a compositional setting. While American students study the rules of voice-leading and occasionaly write compositional excerpts, the harmony class utilizes analysis and composition of keyboard, string orchestra, instrumental solo and accompaniment, and acapella and accompanied choral mediums. American approaches to theory are more analytical and ecclectic, often including the historical perspective in the development of musical practice.[6]

In the composition based harmony class students become acquainted with the master composers of a period by composing pastiche compositions "in the style of" the master composers. Students learn the principles of harmonic progression, creating textures, and composing idiomatic passages for vocal and instrumental ensembles. The use of an existing model for compositions is freely encouraged. Students demonstrate an understanding of the principles of harmony through their compositions and thus learn to think harmonically rather than contrapuntally when composing.

Ideally a class in Counterpoint and an additional class in Form and Analysis should follow the harmony class in the diploma or degree curriculum as a required subject for all undergraduate music students, thereby insuring that all students have in common a core of musicianship and theoretical skills.

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THE COMPOSER AND IMPROVISATION

by

JIM HEARON

Abstract

Morton Feldman's graphically notated work for two pianos, Projection 3 (1951), Karlheinz Stockhausen's intuitive texts Für Kommende Zeiten (1968-70), and James Hearon's improvisational score Concertina for a Solo Instrument and Orchestra (1984) are investigated for the purpose of discovering contrasting approaches to the use of improvisation techniques in the aleatoric or indeterminate style of composition. The three specific works are investigated for their contrasting approaches to improvisational notation. A methodology is put forth comparing similarities and differences regarding the notation of the improvisation techniques utilized by the composers in these specific works. Musical examples are given for the three works indicated, helping to provide a visual picture of the contrasting styles of improvisational notations used by the composers under discussion. Musical results achieved by the contrasting compositional techniques are noted, while recognizing related results in similar works by the same composer. The relationship of the performer to the composer and the improvisational score is discussed for a better understanding of the composer's compositional determinates or indeterminates. A description of aesthetic complexities facing the composer, as artist, working in the aleatoric or indeterminate style of composition is brought forward. Finally conclusions regarding the viability of improvisation as a valid performance medium are drawn for a better understanding of the integration of the two mediums--composition and improvisation.

Introduction

Improvisation and composition, at first, appear to be two distinctly contrasting dialectics. One, representing the power of concentration upon definition and the notation of details for the purpose of being able to generate the exact recreation of musical gestures, the other, being an open-ended opportunity to express choice by the composer and/or performer for the purpose of allowing musical content to be influenced by chance operations. For the composer working with improvisation techniques in composition, a unique vision of the composer as artist, and a well-versed understanding of the new aesthetic principles involved in the integration of the two mediums-composition and improvisation, are important for the creation of reasonable, realistic, and lasting works of art.

In terms of improvisation, the process of translating our intuitions feelings, and spirit into musical constructs requires the exercise of judgement, of estimating possible outcomes, of weighing the result of particular choices, of deciding among unlimited options, and of taking action based upon such estimates. (Fowler 1985, 35:11-12) Like Charlie Bucket, who developed character and exercised good judgement when faced with so many possibilities while touring Mr. Willy Wonka's Chocolate Factory, and was in the end rewarded ownership of the factory for his patience in weighing possible outcomes, improvisation forces us to make instantaneous and spontaneous decisions which influence our next decision and so on.

Determinant Composition, on the other hand, is the result of the regularization and ordering of what was previously vague and uncertain. (Cole, 1974, 149) The symbology of the traditional music of the past, for the most part, makes possible a methodical, incremental description of sound-events which helps preserve that style of performance and the musical notation associated with it. Determinant Composition, also like improvisation, requires the exercise of judgement, of estimating possible outcomes, and weighing particular choices. In the end decisions are made by the composer, however, who carefully calculates and notates those choices so the performer may recreate exactly in performance the composed music using a commonly associated language of musical symbols as the method of communication for those ideas.

Aleatoric Music

Aleatoric or indeterminate music utilizes several new and different types of notation. Generally this music of chance involves some type of decision making for the performer, if not outright total improvisation. Yet improvisation, for the composer, is perhaps one of the most fleeting ways of bringing a musical artistic vision into reality, because in terms of notation it is often purposefully ambiguous, indeterminate, aleatoric, noncommittal, and vague. Notation for improvisation eschews the obvious specific statement of events in order to encompass all those possibilities of events which are imagined and not yet imagined. It brings together a host a possibilities, and a virtual lack of possibilities all under one heading which reads: "free improvisation" (you are free to do what you want to do).

By notating a schema, which is a diagrammatic presentation, for a musical work, the composer is like the designing architect in that he plans or designs the musical result but does not actually bring those plans into reality. The composer sees the artistic vision, and writes down a brief roadmap of how to get to this magic garden of the imagination on the performer's experiential journey thru the land of creativity. We are led back to this place by the composer's schema (directions), but we cannot realize its significance unless we actually put forth some effort into making the improvisational work a musical reality. The composer may be said to have composed ideas and concepts in using a diagram, but not music, and this is somewhat frustrating for the composer in that the artistic vision is never made real, but is passed over in favor of the discovery of still newer and different ideas.

Projection 3-graphic notation

Morton Feldman's Projection 3 was an early improvisational graphic work dating from 1951. In this work for two pianos, the graphic framework for the sparsely indicated musical content consisted of a one line staff, around, over, below, and above which were placed boxes representing chords of relative pitch height, each containing a number indicating the amount of freely selected pitches to be contained within each chord (Fig. 1). Pitch was notated relatively high, middle or low, and the number of freely selected pitches in each harmony ranged from 1 to 10. (Bland 1980, 6:455) Duration was indicated by the amount of time taken up by a visual cue notated as successive sectionalizations along a horizontal line each of which could potentially represent 4 icti, or pulses. Of the four lines notated, two parts are played by each player and the lower part for each player is to be a resource for sympathetic resonances for the upper part. (Feldman 1964, intro.)

This work was not so much an avant garde composition in terms of notational technique, as it was of conception. With Feldman's previous additional two works in the Projection series (Projection I, for cello, 1950, and Projection 2, Flute, trumpet, piano, violin, and cello, 1951) and several other scores from the time, for ex. Earle Brown's Folio (1952), John Cage's 4'33" (1952), and Christian Wolff's Duo for Violins (1950), new ground was broken by American composers in the use of graphic and improvisational notation. Projection 3 , for two pianos, was remarkable for its interest in different densities and combinations of timbres, played softly.(Bland 1980, 6:455) In an interview with Robert Ashley in 1964, Feldman stated that there was an early deity in his life, and that was "sound". Everything else was after the fact. (Schwartz and Childs 1967, 364)

This piece is a good example of the type of "performer indeterminacy" described by Michael Nyman in his book Experimental Music. Nyman actually writes about three types of indeterminacy: composer indeterminacy, performer indeterminacy, and composer and performer indeterminacy, and was writing not so much about Morton Feldman as about works by other well known composers such as Earle Brown, John Cage, Barney Childs, and Cornelius Cardew. Feldman's title, however, Projection 3 makes a statement and tells us about the superimposition of the artist's vision upon the realities of the performing environment whereupon the composer interjects only his idea and not the realization of that idea into the performer's domain of musical performance.

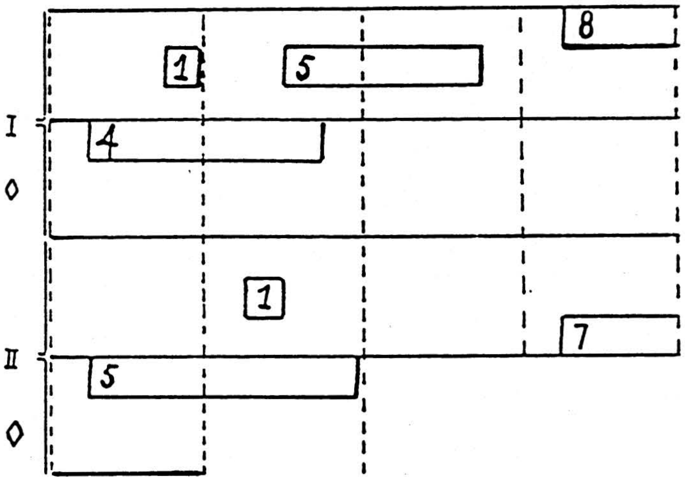

Fig. 1. Morton Feldman: Projection 3 . (C) 1964 by C.F. Peters Corporation. Used by permission.

Für Kommende Zeiten-intuitive texts

The 17 texts for intuitive music by Karlheinz Stockhausen from 1968-70 consist of brief texts which include ideas for improvisation (Harvey 1975,113), in the form of a verbal score, for large ensemble, small ensemble, and piano duo 4 hands. According to Karl H. Wörner, Stockhausen differentiates between indeterminate composition (such as Zyklus 1959, 1 percussionist, and Refrain 1959, for 3 players) as polyvalent formation, meaning the composer writes possible solutions from which the performer is allowed to choose a suitable version, as distinct from intuitive music. (Wörner 1973, 105-7) Stockhausen says the performer becomes a medium when playing intuitively. He also states that the best intuitive musician is really at one with his instrument, and knows where to touch and what to do in order to make it resonate so that the inner vibrations that occur in the player can immediately be expressed as material vibrations in the body of the instrument. (Stockhausen 1989, 123-125) The last chapter of Jonathan Harvey's book *The Music of Stockhausen* (1975) covers a previous set of 12 intuitive texts Aus den sieben Tage (1968) by Stockhausen in which Harvey states that these slightly earlier intuitive texts may be seen as metaphysical extensions of the theory of temporal vibrations as expressed in the article "how time passes" by Stockhausen (*Die Reihe*, Vol. 3 pp. 10-40) in which the composer extends the unity of musical time to the unity of matter, which likewise exists in the form of vibrations of time. (Harvey 1975, 117)

The instructions notated in Für Kommende Zeiten not only contain text, but music and symbols as well (Fig. 2). Erhard Karkoschka has written that a primary reason for utilization of verbal instructions in music notation is that of notating actions. (Karkoschka 1972, 3) Karkoschka is not writing so much about "action notation", such as music for the recorder instrument defined and notated by fingering charts, rather action notation as a set of verbal instructions which define by words the procedures required of the performers in order to produce the type of music desired by the composer. (Cole 1974, 38-43) Paul Griffiths states that the overriding purpose of the use of intuitive texts by Stockhausen was spiritual and to make possible a musical meditation. (Griffiths 1978, 180) The directives given to the performers in the verbal intuitive texts, for example no. 4 ,"Interval" for piano duo 4 hands, "to be played with closed eyes", helps provide for a maximum of personal introspection and intuitive responses by the players. Although Stockhausen prefers the the term "intuitive music" to improvisation, because the word improvisation always conjures up certain rules of style, rhythm, harmony, melody, and order of sections, etc. (Stockhausen 1989, 113), Reginald Smith Brindle notes that text scores comprise verbal descriptions of what should be improvised, and that the text suggests a mood the players must create, a manner of playing, a certain kind of musical action, and combinations of these.(Brindle 1975, 96)

While the verbal score and the use of words may be the most obvious type of symbolism in terms of music notation, the structure of language and its notations definitely influences modes of thought by its users. In this case, the verbal score as a new notational technique, has opened the way to new ways of thinking about music. (Cole 1974, 12-13)

Concertina for a Solo Instrument and Orchestra- improvisational score

The work, Concertina for a Solo Instrument and Orchestra, from 1984 demonstrates yet another approach towards the use of improvisation in the musical score. This work follows several other compositions in which I was concerned with improvisation primarily as an element

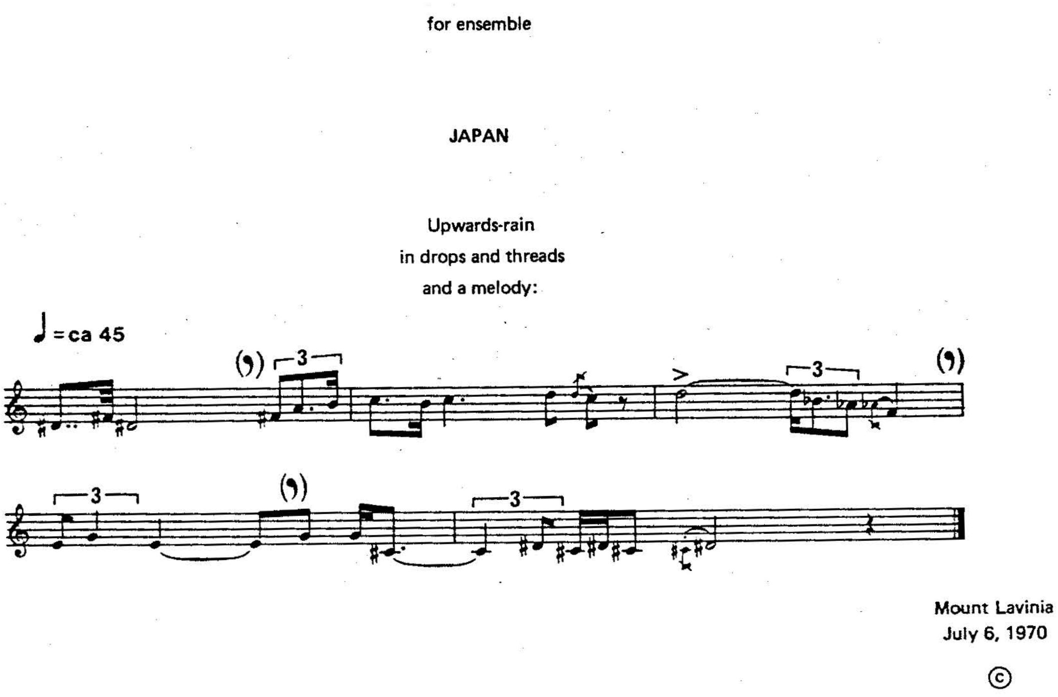

Fig. 2. Karlheinz Stockhusen. "Japan" from Für Kommende Zeiten .

of the formal structure of a composition. Throughout the course of composing this work, an approach was maintained towards allowing the improvisational elements of the form to influence the musical structure to a large extent. The use of dark, solid lines to outline and offset an improvisational section in the music called "rahmen notation" is a type of frequently used frame or box notation common to aleatoric and indeterminate music which was perhaps first used by Luciano Berio in his piece Circles(1962). The clear indication that whatever takes place within the particular boundaries of the frame is relegated a certain amount of freedom, helps clarify notational formal procedures for the composer, although not necessarily for the listener. In the Concertina the formal boundaries of the frame's shapes become more integrated, overlapping, extended, and multidirectional (Fig. 3) which adds dimension to the formal structure otherwise unobtainable by simple juxtaposition of improvisatory and non-improvisatory formal elements.

An outstanding feature of the Concertina is the fact that practically all the compositional performance information is imparted to the players in the generic instrumental parts (woodwind, brass, string, and percussion). The conductor's score is simply a time-line of event entrances and exits with numerical cues. The soloist has no written part, but must "make-up" or improvise the music, much like virtuoso performers of the past who improvised their own cadenzas to the standard concertos.

Time and texture, however, are carefully controlled in the piece, and are the real conflict generating forces beneath the surface of the composition which actually create the effects perceived in the juxtaposition of the various musical gestures. Specific durations of textural configurations of instruments were employed in the composition consistent with proportions of alternating tutti and solo sections of a typical first movement concerto form. Compared to the weight and balance of the various contrasting sections,

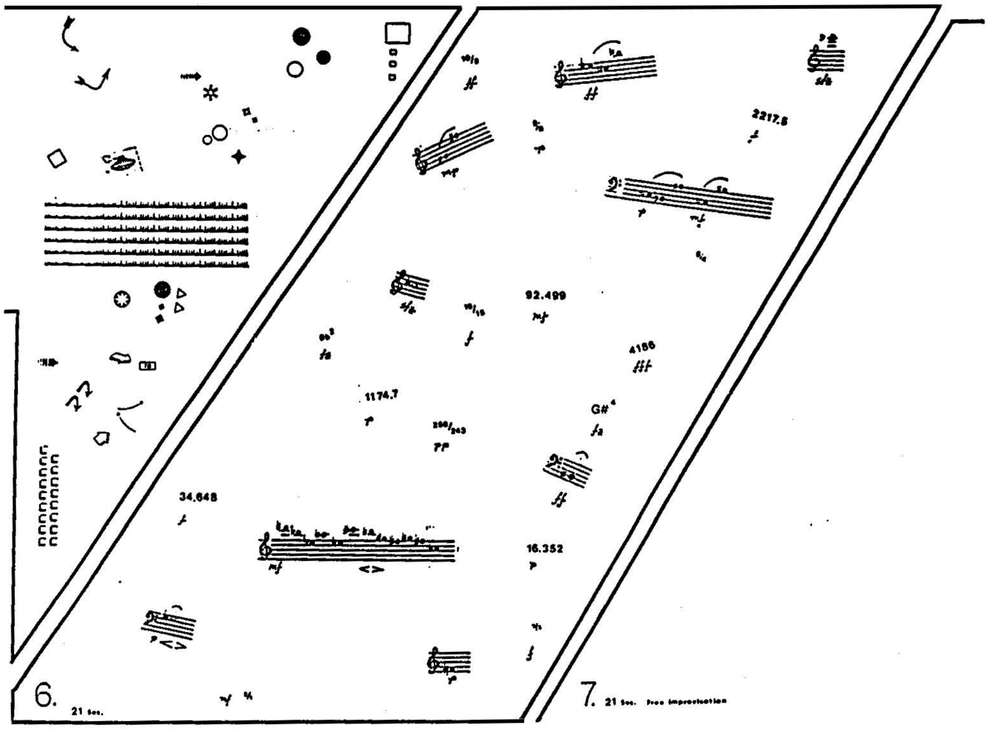

Fig. 3. James Hearon. Concertina for a Solo Instrumenta and Orchestra. Used by permission.

the amount of time allocated for a soloist's cadenza (around 5/8's total duration of the composition) causes a natural tendency for the orchestra players to return playing loudly and forcefully, somewhat like a final tutti section, just after the soloist has completed improvising the cadenza. This phenomenon is probably explained as more a matter of the players being held back, or forced to maintain silence for a specific duration somewhat longer than before in the piece, and thus the natural tendency is towards motion by the players at that point. Nevertheless the fractionalization, sectionalization, and instrumentation by time of the entire composition lend a certain centrifugal force to the ending consistent with a final tutti and concluding section of first movement concerto form. The approach to this composition was not a conceptualization of sonority in schematic notation like Morton Feldman, or a prose-text description of improvisational performance actions as in Stockhausen's work, but rather a formal approach to composition in which sections containing variously notated improvisational techniques were combined on paper in a traditional musical-structural context.

Conclusion

Aldous Huxley writes in "Variations on the Philosopher" that art is one of the means whereby man seeks to redeem a life which is experienced as chaotic, senseless, and largely evil. Huxley was writing about George Herbert a man who enjoyed music as a permissible pleasure which provided a certain mystical satisfaction, and thus a foretaste of perfection and an insight into the ultimate nature of things. (Huxley 1950, 120) If art represents the will in humanity to strive, to soar upward, explore, and seek changes for a brighter, better future based on new principles, ideas, and concepts, then art makes those noble human ideals tangible by bringing that lofty artistic vision into reality, embodied in a concrete work of art, which can be seen, felt, heard, smelled, or tasted in order to excite the human emotions and ideals which lie within each individuals own unique and personal references which are so closely related to those noble human ideals.

If improvisation represents a type of instantaneous composition, or a piece of music which is composed the instant it is heard, then notation for improvisation helps deliver that fleeting, yet convincing artistic vision into a media form which allows the composer's ideas to be examined, analyzed, and performed again, after a fashion, not unlike the traditional musical score. Improvisational scores therefore represent an important medium for the composer which is neither the traditional definitive musical score nor the improvisational performance it strives to represent.

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Composition as Process

INTRODUCTION

The idea of composition as process looks at the act of composing through various methods utilized for the composing deterministic music. Determinant composition is the result of the regularization and ordering of what was previously vague and uncertain. (Cole, 1974, 149) The symbology of the traditional music of the past, for the most part, makes possible a methodical, incremental description of sound-events which helps preserve that style of performance and the musical notation associated with it. Determinant composition requires the exercise of judgement, of estimating possible outcomes, and weighing particular choices. In the end decisions are made by the composer, who carefully calculates and notates those choices so the performer may recreate exactly in performance the composed music using a commonly associated language of musical symbols as the method of communication for those ideas.

Since composing music is an inner game, the methods used in composing deterministic music are conceptual in nature, and somewhat similar to one another. These processes can be grouped into large categories--the first of which is a process called deduction.

DEDUCTION

Deduction is a process of clarification of the issues which surround the inner gesture of the composition. In the overall scheme of the composing process, deduction is very important, for it is through the deductive process that ideas are brought from the macrocosm into the microcosm of the inner consciousness.

Through deductive processes the composer also gains a knowledge of the problems and challenges which are involved in the working out of an idea, and attempts to refine those ideas from gestural form to the point where it becomes clear enough to begin work on the actual composition.

Determinant composition is a challenge, and involves taking something from the unknown subconscious world of dreams and bringing it into the world of conscious reality. Aldous Huxley writes in "Variations on the Philosopher" that art is one of the means whereby man seeks to redeem a life which is experienced as chaotic, senseless, and largely evil. Huxley was writing about George Herbert a man who enjoyed music as a permissible pleasure which provided a certain mystical satisfaction, and thus a foretaste of perfection and an insight into the ultimate nature of things. (Huxley 1950, 120)

Art, in general, and composition in particular represents the will in humanity to strive, to soar upward, explore, and seek changes for a brighter, better future based on new principles, ideas, and concepts. The composer's art makes those noble human ideals tangible by bringing that lofty artistic vision into reality, embodied in a concrete work of art, which can be seen and heard in order to excite the human emotions and ideals which lie within each individuals own unique and personal references which are so closely related to those noble human ideals.

The germinal idea for a composition does not always come from pure phantasy however, and is not always ultimately noble, but may often exist as bits and pieces of imagination, combined with remembrances of music heard in the past, as well as stored resources or creative thoughts often temporarily abandoned and placed "on the back burner". The quasi-real nature of the initial idea indicates that there may be problems, challenges, and issues with which one can grapple and solve as a precompositional activity before composition can begin. Therefore if a germinal idea is too transparent, for example, there may not be enough reward or satisfaction at the end of the working out process, and the idea does not seem to be a good one which would ultimately cause it to be discarded outright as faulty or defective, or possibly maintained in memory for use at a another time.

Ideas which tend to excite the composer are the ones which have an illusion of complexity and can provide the reward or artistic satisfaction sensed potentially through the initial germinal idea. This type of deductive compositional activity is predominantly and initially an intellectual pursuit, and that may be what attracts that certain type of artist to this process.

Since deterministic composition implies the working out of details in an intellectual manner, the composition itself is only representative of a solution to those initial ideas. There may be many different versions of the composition in order to reach those solutions, rough drafts, and various notations in graphic form which ultimately lead to a result and a finished product. The final product is only a representation--and in many cases a very economical and streamlined representation--of the many different problems that have been solved to get to that point. Many different possibilities and problems are sometimes inherent in an initial idea, and a selection must be made among those possibilities in order to find the best solution for the representation which is the finished composition.

WORKING IT OUT

The process of actually working out the details of a composition comes after the deductive processes have taken place. Working it out, is where musical ideas are brought into the real world in tactile form. After precompositional details have been solved, and writing the composition begins, the composer has a direction for his or her ideas, and is able to implement the act of composing as part of the a deterministic process. The day to day challenges of composing and bringing the composition into a tactile form--wheather it be a realization of a computer music piece for audio tape, writing notes down on staff paper, drawing ideas for graphic representation--or whatever form the composition takes, involves the working out of details.

In the working out stage of a composition, a composer normally employs at least one, and usually several of the various compositional techniques and procedures available for composing music. Instinct, for example, may be useful to a great extent, in order to sense, and seek for possible outcomes and results. The intellect is involved, but during the working out stage assumes more the background role as craftsman, while the intuition takes charge to help guide the artist thru the stage of actually assembling the composition from the germinal idea in order to help suffuse the composition with clarified precompositional details.

Some of the processes commonly associated with deterministic composition are first of all trial and error--where comparing and contrasting to achieve unity and variety in the composition are employed to see what ideas sound like, what events look like on paper, or how the music flows. The composer may become dissatisfied and change ideas through the procedure of accepting and rejecting ideas. Trial and error is a compelling part of the compositional process and is used more often than not as the first and most functional process in composing music.

Improvisation is another method used to help develop musical ideas in a composition, and generally tends to help bring out musical ideas in a way which supersedes what the cognizant self, through intellect and trial and error trials, are able to accomplish. Improvisation helps develop musical instinct and can propel the composer beyond merely what the craftsman is able to accomplish. It also helps to bring subconscious ideas into the world of reality. Those ideas are usually very influential, organic concepts, which often can be used to a great extent as integral in the working out stage of a composition. When improvisation is mixed with deterministic compositional procedures, it allows the intuition more room to perceive while the intellect employs these ideas in order to help move a composition forward.

Accidents may also become a significant part of the working out process of a composition. A slip of the pen, writing a note which has not actually been intended, may cause the composer not to immediately discard that action, but instead to see what the musical result might be. Many times accidental events are inspiring, and assist in moving the music forward in unexpected, new, and interesting ways which provides elements of spontaneity not normally present in a composition. Capricious or serendipitous aspects of making music are a natural and integral part of the deterministic process.

There are also many systematic procedures which may be maximized by the methodical composer in the working out stage of a composition. Serialism is one viable methodical system, although many composers have begun to tire of using this method exclusively. More often serialism is utilized as an added element within the larger scope of a group of deterministic processes, much like a spice might be added to a good meal. Serialism is useful because it admits all the possibilities available in the equal tempered system all at once--so to speak, and enhances a composition's pitch spectrum with brilliant hues and contrasting varieties of color. At the same time, serialism can make the music bland via a persistent use of panchronal materials. Another way to put this is to state that there is often too much of a good thing which may lend a type of stiffness and artificiality to the music. Hindemith states in the Craft of Musical Composition that "In reality, wisely and sensibly directed work will result in greater variety than a profusion of over-seasoned or over sweet progressions...". (Hindemith 1941, Vol. 1, 9) Therefore serial methods often work best combined with other systems such as stochastic processes which are used to generate random distributions of any length of numbers used for pitches, velocities, and durations etc.

Microtonal and macrotonal tunings may also be utilized to help provide interest and variety and expand the systematic use of materials into the use of exotic, folk even primitive resources. The contrast provided by the use of a broad panoply of systems including various rhythmic systems, the use of modality, diatonicism, pantonality, pentatonic scales, serialism, stochasticism, and microtonality allows the composer access to a wide array and choice of materials, and thus the potential to be ultimately more expressive musically.

Many post-serial composers employ different systems to compose. The use even of a flexible system of systems is not uncommon. The composer uses not just one particular approach, but rather many different systematic ideas together in one composition. New Music composition is based on the aesthetic assumption that freedom of expression is truly achieved by knowledge of as many procedures as possible. (Cope 1977, p. x) Another name for this procedure is eclecticism. Eclecticism simply for the sake of writing in that style should be avoided, however, for an artistic eclectic uses eclecticism in an arbitrary and artistic manner for the ends which suit that person most providing the maximum artistic benefit. The artistry imbued thru the sense of stylistic eclecticism is something uniquely characteristic only of a particular individual artist. The artist should strive to bring his or her artistry to every composition attempted, in order to allow each work to say something unique and individual about the artist's own creative abilities. In this way the composer moves beyond mere use of systematic choices, and incorporates a true expressive and artistic personality directly into the compositional process. A truly great original and artistic work, representative of the unique gifts of a composer, however is something often seen in retrospect, after the work has been composed, and not necessarily the product of conscious systematic decision making processes.

Still other processes utilized in the working out of a compositional idea, come under the category of holistic or universal procedures. These compositional procedures are all encompassing in scope, and affect all other parameters of the work in question. One of these holistic procedures is collage. Many composers borrow ideas from previous works, or use material which is concurrent with another work. In composing my *Sonatas for Violin and Synthesizer*, for example, I planned to write altogether six sonatas. After writing four of the Sonatas I took a brief sabbatical from the work and was working with some earlier computer music pieces. I discovered quite by accident that one of the computer music pieces would be perfect as an electroacoustic tape background or accompaniment for one of the Sonatas, and this inspired me with the idea to use it as the basis for composing the fifth *Sonata for Violin and Synthesizer*.

Filtering is another all encompassing process. Filtering can be a rather transparent action using additive and subtractive procedures in the working out of a composition, such as suddenly adding an element which provides interest, variety, or surprise, or consequently taking away an element from a texture which seems to be too crowded. This is a simplistic but accurate description of how this process works. It generally helps provide equilibrium for the music at some point where refinement is needed in order to reveal essential ideas or material.

Correction and revision are also very important all encompassing procedures which affect the outcome of a work of art. At times a composer may move ahead rapidly with a compositional idea in the interest of getting a certain amount of the work accomplished before a gestural image begins to fade in mind. Thus the composer is attempting to complete the sketch as quickly as possible and often minute details are not accomplished as carefully or effectively as possible. Mistakes may also be made in calculating the way an event should be notated, or ideas become misplaced in the overall succession of events. An effort should be made to elimante what Paul Hindemith terms "dead points" in the music, or places where the music looses its dynamic flow, interest, and vitality. (Hindemith 1941, Vol. 1, p. II) Underestimation of the overall proportions of a composition is a common compositional error. Therefore proofreading and correcting may be required to move a work towards accuracy and completion. Getting back into the composition's working out stage, and refining, often revising a roughly completed sketch can be a meticulous and demanding task for the mercurial and fast paced composer. The rewards of at least one good, complete, and polished work may outweigh in the end, reams of unfinished, roughly sketched compositional ideas.

Thus all the compositional processes and procedures listed above, utilized either separately, in part, or as a whole, contribute to the composer's sense of individual style. It is the composer's perception of style which is ultimately responsible for the devotion one maintains to developing a truly personal and unique musical language. It is the pursuit of musical style which is responsible for the formation of a composer's unique compositional language which contains elements of various processes, and procedures. To the extent one is satisfied with the succession of ideas, the proportions and balance of a work, and the technique and materials employed, style allows a composer's work to speak musically in the way the composer intends it to speak.

SYNTHESIS

At this point--somewhere between the final stages of the working out of the details of a deterministic composition, and reflecting back upon the work as a whole--the composer generally gains a synthesis of ideas. Through synthesis, the composer is able to bring together ideas and concepts which have been integral to the composition, which may include ideas from the immediate or even remote past, in order to help provide a clearer indication of the path into the future the composer might take on his or her path of development. This intuitive approach allows the completed composition to stand as a work in the progression of a total body of work, or the lifework, and the synthesis of ideas helps the composer view the path into the future more clearly. Synthesis also provides a clearer view of the path one may also have followed in the past to arrive at a present point of development. In many instances the composer is able to bring together ideas during this stage to form numerous groupings, to put events together in order to move forward more effectively, and to collect ideas into categories which are similar, in order to identify unifying factors in his or her work. It is crucial for synthesis to take place before the final stage of a work, termed reflection, becomes significant.

REFLECTION

Reflection is essentially the philosophical stage of the process of composition. While looking back upon the processes involved in a composition, real learning takes place as a result of the composer's ability to sum up the various accomplishments of a work of art, and condense those aspects into meaningful and significant thoughts. Summing up, means recognizing the strong points as well as the weak points of the composition, and remaining objective about the relative value of each area--positive or negative. The reflective process can therefore at times be mildly painful and might occasionally bring to light misconceptions about the working out of compositional details in terms of the works' holistic parameters such as proportion, balance, and presentation of ideas, etc. During the reflective stage of the composition sometimes comes a rather sudden realization that the work is not as strong as it needs to be in certain areas. Thus a decision has to be made at that point to revise and correct the work as a whole, or more or less discard the work and compose an altogether new work--even one in a similar style.

Hence reflection allows the composer to estimate the value of a composition in terms of the total artistic merit of the work. This value may be relative and temporary, and can be synonymous with other types of compositions and values from a progression of several works or a larger body of work taken as a whole. For example, the value of a composition might signify that it is important in terms of scope, medium, or representation as a stage of development and achievement for the composer. The work may be valued highly, furthermore, for a specific value such as didactic, pedagogical or other educational purposes. Therefore a work's value may be seen as relative within the progression of a larger body of work taken as a whole.

A composition may also be seen as valuable as a result of the combination of several areas of worth, which may signify the sum of the works' positive elements which contribute to the total determination of the worth and value of the piece as a whole.

Reflection does not necessarily have to to be regarded as a lengthy stage in the compositional process, but may take place gradually as the composer gleans more the effect a composition has upon performers and audience members alike gradually through premiere performances, and readings of the piece. For example, the composer's estimation of the importance of a work may go from initially very high to subsequently somewhat lower as the work becomes more accepted or rejected by the mainstream.

Reflection might provide an indication to the composer of how well the initial gestural idea of the composition has been realized as the composition reaches its final shape. In many instances, during the reflective process, an impression of the initial idea compared to the image of the completed work may be vastly different, and should realistically be more profound, while the awareness of the various details of the composition are usually still quite fresh in the composer's mind. A composition may be in reality, more intricate and complex in the composer's mind than was initially perceived while the ideas were in gestural form. Nevertheless the two images should begin to compare favorably at some point as the composer looks back and contemplates the significance of the work as a completed whole.

Reflection is important in the compositional process because of its philosophical attributes where occasionally the craftsman in the composer is concerned only with musical details and nothing else. The language of the composition, to the composer, may be a succession of musical events put forward thru the use of musical technique in details, and the result or the impression created by the composition may be one of exciting certain types of emotions in the audience, or the creation of certain moods or ambience through the use of these techniques. Therefore reflection can provide an estimation by the composer, who is after all the person who knows the work the best, as to what type of extramusical characteristics are normally attached to the work in question. The composer is able to provide a more accurate description of these extramusical attributes of the composition, through reflection and observation, by functioning as what might be called the "most informed objective listener" of the composition. It is important that the composer relax, at some point, and not listen actively and critically to a work, but instead listen passively, simply enjoying the music and making general extramusical observations about the piece.

Reflection may further assist in intellectual development for the composer as well, for it is a good idea for composers to provide a rudimentary analysis of their work. Although in many cases theorists would prefer to separate themselves from composers in terms of the result and nature of their respective academic disciplines, but the composer is no doubt the best qualified to provide an initial indication as to the intended theoretical content of a work. This may help theorists, who subsequently may be more inclined to delve into the abstract theoretical content of a work, by functioning as an initial guideline, outline or introduction to the work. It is important that a composer match and compare initial perceptions, which may have been original compositional goals, with the final realized results, and then state objectively and clearly what in fact are the formal contents of a work, or the various sections of a work. The delineation of formal divisions may help scholars and audience members alike to understand what it is that the composer actually believes are the natural formal divisions of a work. Thus analysis, by the composer, is an important part of the process of reflection.

Finally the reflective feeling that a composer has for a particular work, may change over the course of several years. It is nevertheless very important that a composer's impression, and thus reflection upon a work, be made from the acoustical phenomenon which is made by music being performed live, and not simply from some vague imaginary idea of what the work might sound like. It is crucial that the composer attempt to gain a reading of the work as a whole or in individual sections, so that he or she may have a better idea as to the acoustical consequences of the music, the effect the music has upon performers, if there are technical or idiomatic problems in the composition, and if there are problems otherwise in the music such as general errors in the parts or score. The impression that the composer has of a work should be formed from accurate auditory fact, not a delusional, illusory, or vague imaginary impression. A reading session may help provide the composer with this larger, complete and more confident image of the work.

CONCLUSION

In summary the realization and performance of a new work of music is a tribute to the long and arduous creative processes which contribute to its existence. In many cases the rather brief duration which the work spans in time, is only remotely indicative of the immense amount of effort and energy required to create a work of art. The deductive or precompositional aspects of a deterministic composition, the working out of the technical details of the piece from the initial germinal ideas, the synthesis of those ideas and concepts involved in the work, and the ultimate final stage of reflection upon the contents of a work and the determination of its relative value and worth, are only some of the important characteristics and properties intrinsic in the act of musical composition.

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ENSEMBLE IMPROVISATION

by Jim Hearon

The ultimate in musical synchronization, in terms of ensemble playing, is perhaps best heard in many of the world's finest orchestras, bands, combos, and chamber music ensembles. The musical score, and its interpretation by a conductor or bandleader is, of course, the main reason a particular orchestra or band achieves success in ensemble playing. In chamber music and combos, the score, chart, or leadsheet exists, but the sensitivity of the players to the details in the particular parts helps create the sum total effect for successful ensemble playing in musical performance.

A controlled approach to ensemble playing is directly opposed to the spirit of ensemble playing in free improvisation, yet ideally the final result or the success experienced by both approaches should ultimately lead to the same place, which includes elements of ensemble unity, synchronization of parts, sensitive musical interpretation, projection of emotion, strength of performance technique, and polished performance skills, just to name a few elements. For improvisors, the idea--fluid, free, and flowing, is of supreme importance. Ideas should remain easily changeable in their original essence as creative thought, but are projected into the world of reality thru sounds which are the medium for the communication of those ideas. Once an idea is in concrete form, such as on paper, in a score, then it has lost some of its original brilliance for improvisors because it cannot be varied as easily as previously in its state of creative essence. There is usually no limit to the number of free flowing ideas coming from the various individuals in group ensemble improvisation, however a problem exists in trying to focus those ideas into a coherent musical structure, spontaneously.

In most cases free improvisation ensemble playing does not utilize a group leader, conductor, or score, nevertheless limits and controls are imposed upon the direction of group improvisation by the members themselves thru the ideas presented. Where improvisation is truly spontaneous, this procedure is usually a vicarious and intuitive imposition. In a completely free improvisatory environment, where presumably no musical utterance is in "bad taste", a musical contribution presented during an improvisation may nevertheless be outside the realm of the normal acceptable stylistic boundaries of the ensemble. This musical offering will seem then, by comparison, to appear unacceptable. Thus free improvisors impose limits and extents upon the scope of their improvisational activity when working within ensembles. This may simply be the result of one or more players coming away with a "bad feeling" about what was played, or more appropriately realizing that what was played was in "bad taste".

Stephen Nachmanovitch states in *Free Play*, his book on improvisation, that ordinary conversation between people has much in common with musical improvisation. In general Music and Linguistics do have very much in common because they both begin with the same original idea, which is communication thru sound. To carry this analogy further into the realm of ensemble improvisation, which would be different from ordinary, everyday speech dialogue where one person usually waits for the other to finish speaking before starting into a new thought, responding, denying, or agreeing with the other person, imagine for example, a crowd of people each trying to get their point across to a lecturer or person standing up in front of a crowd who is attempting to field public opinion. In this case many people are speaking at once, some yelling vociferously, without regard for courteousness or politeness and the speech of others. Each person is hearing what the most vociferous person had to say previously, and each person usually makes a point slightly different, if not outright contrasting, to that of the person who was just heard. Another extreme example of this same phenomenon would be a sports event where the players of the two opposing teams are often yelling, chanting, screaming, carrying on, etc., and call out often without regard for true communication with the fans of the opposing team. Thus it is possible for many discrete sounds of ordinary speech to exist simultaneously in time and space with varying degrees of relationship to each other--from those of no relationship at all, to those of saying the same thing at the same time.

There are several examples of this phenomenon in music. In Earle Brown's *Available Forms 1 and 2* (1961-62) precise notation is utilized in the score, but the form of the music remains open and undetermined until performance. In *Available Forms 2* the orchestra consists of two groups, each with its own conductor. Each conductor selects musical sections to be performed by his group, from the numbered parts of the score in accordance with material which is suitable for that particular moment. The form of any complete performance depends upon the sensitivity of the players, and the conductors who act also as interpreters. At times, musical events may be heard which are totally independent of one another, where the performers are more or less oblivious and insensitive to other musical events taking place within the same space, but where at any given instant a performer is nevertheless able to listen and respond to a miniscule part of the whole event in a way which indicates communication and mutual understanding. Whether or not a completely independent type of polyphony of this type is successful as music, depends upon the the listeners ability to accept this expanded boundary which was viewed as avant garde and new in terms of an expanded definition and further development of musical taste. This approach however is diametrically opposed to the common practice of musical development where separate musical parts, for example in an orchestra composition, are normally derived from, and consonant within a single harmony which binds the parts together and gives them meaning within the context of the progression of a work as a whole. Completely homophonic, or chordal music, such as a Chorale by J.S. Bach, and the completely disparate, independent, and accidental, polyphony of an indeterminate work might possibly represent the extremes which would help determine the extent and limits within which an improvised music ensemble will progress while utilizing traditional musical texture and resources. Modern music, however may add such resources as microtonality, the use of natural, sampled, and inharmonic percussive sounds, expansions of timbre, range, and register thru the use of music technology, and audio recording and playback to help expand those limits to include additional dimensions.

In one sense, handling the improvised ensemble is like handling radioactive material. We want control for the benefit of focusing the potential energy, but we cannot touch, shape or handle it directly for fear of destroying it, or possibly destroying ourselves. It must be handled instead carefully, and from a distance. We want group improvised music to be truly spontaneous, creative, and original, but also to maintain a sense of underlying organic unity, no matter how independent the parts may become.

Spontaneous contact group improvisation, where musicians are brought together, often from immediate backgrounds and recent experiences which are quite different, may be successful initially only in terms of meeting one goal which is that of achieving unity of purpose. Nevertheless as extents and limits are defined in the microcosm for the group thru the musical personalities of the players via displays of leadership, aggressiveness, virtuoso musical technique, daring, auditory sensitivity, emotional rapport and various instrumental ranges and timbres and the like, an organic unity within the group may begin to emerge, even while new musical ground is being covered when improvisation is taking place. Intuition normally plays a large role in the unspoken, yet understood, roles which develop within a group among the players. Good improvisors have a highly developed sense of intuition and are usually very sensitive musically, and adept at projecting a kind of confession and telepathy which is beneficial to the communication and mutual understanding which helps move a group improvised musical structure forward coherently.

Other improvisors may employ a predetermined strategy which naturally lends itself to the creative activities of games and play. Devices, such as numbered cue cards, or other aural cues (whistles, beepers) or visual cues (video, film, digital stop watch displays), for the purpose of organizing time and/or the placement of events could be useful to help fulfill a proposed game or strategy of play. A player who does not play by the rules, may appear to be "out of bounds" temporarily. Conditionally all play is experimental to ascertain if the rules of the game produce effective and satisfying results and, like any good experiment, different methods of experimentation should be utilized in order to help determine results.

Several notational approaches to contemporary music in the past have evolved which lend themselves readily to be used as effective tools for the production of group improvisation. The following scores represent just a few of these examples: Morton Feldman's schematic notation for indeterminate harmonies in *Projection 3*, 1952; John Cage's graphic scores such as *Variations I*, 1958, and *Fontana Mix*, 1958; Luciano Berio's *rahmen notation* or outlined rectangles signifying what is inside the rectangle or square is to be played freely from *Circles*, 1960; Roman Haubenstock-Ramati's Mobile from *Mobile for Shakespeare*, 1968, where the player reads multi-directionally from the field of events; Pauline Oliveros's text pieces in *Sonic Meditations*, 1974; and Karlheinz Stockhausen's *17 Texte für Intuitive Musik*, 1976, which outline a multitude of inward and spiritually based directions for intuitive playing.

Below is a hypothetical musical example, a "text piece", which might yield satisfying ensemble improvisatory musical results.

Inner Play

A strategy for group improvisation

Part I:

Several performers playing diverse high and low pitched instruments form a pattern, such as a circle, square, rectangle, or triangle, etc. on the stage or performance area, with instruments facing the audience. Turn out the lights. One performer, designated beforehand, starts to improvise and is joined by the other performers, at successive brief intervals, around the pattern counter clockwise until all players are playing at will. When all the performers have entered the "play" the designated performer stops playing and steps into the middle of the pattern. All music stops.

The designated performer plays a brief solo, and returns to his/her spot in the pattern. The performers then play, following the designated performer, in successive entrances clockwise around the pattern until all players are again playing at will. The designated performer stops and steps into the middle of the pattern. All music stops.

Part II:

The designated performer returns to his/her spot in the pattern and plays a long sustained note. All the performers, including the designated performer begin at once playing freely at will. The performers stop playing and remain silent at successive intervals around the pattern counter clockwise beginning with the designated performer. When everyone has stopped playing, the designated performer remains on the pattern, starts to improvise freely, and is joined successively by the other performers at brief intervals, around the pattern

> clockwise until all players are playing at will. When all the performers have entered the "play" the designated performer stops and steps into the middle of the pattern. All music stops, and the piece is finished. Turn on the lights and exit the stage or performance area.

The extent and limits to which a performer's improvisation will sound in bad taste is defined by the rules or directions of this piece. The rules, which are simply directions in the form of text, are also the score to the piece. The so called "designated performer" may likely be viewed by the audience as the leader or conductor of the group improvisation due to the nature of the rules by which the game is played. Therefore this piece will have several elements of a more traditional compositional work of art, however little it may bear in resemblance to the same in actual sound.

The imaginary improvised group performance presented above, however, would consistently pale in comparison to one of the same, arrived at by a group of players totally and convincingly intuitively. For some reason, we prefer the notion that spontaneous music making must be arrived at spontaneously in order to be both legitimate and effective, else it is infused with compositional elements and therefore moving more towards composition than true spontaneous group improvisation. Spontaneous and intuitive ensemble musical accomplishments are indeed impressive, truly amazing, and communicate to audiences instantaneously the same creative processes exercised by composers in more traditional works over longer periods of time. The opportunity for creating such amazing feats of improvisational activity might be increased by experimenting with various and contrasting approaches to generating underlying organic organization in ensemble improvisation by working with a number of different techniques to help increase sensitivity and the develop more intuitive playing capabilities. Also employing common devices such as working with a conductor, cues, film, video, digital stop watches, strategies, games, text pieces, even scores, etc. might help a group develop a dynamic arsenal of group improvisatory techniques which can contribute significantly to a greater depth of performance, skill, and virtuosity in ensemble improvisation.

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Experimental Research in Improvisation

by Jim Hearon

Having been a college music teacher for several years, I was interested in learning how to make the subject which interests me most--improvisation, into a more acceptable discipline for academic research and study. In contemporary classical and jazz music, these two pursuits--improvisation and academic research--have for a long time seemed diametrically opposed to one another, since aleatoric or indeterminate aspects of new music and free jazz have tended to be looked on, rather sadly, by the academic establishment as "far out", "weird", "uncontrolled", and "eccentric" compared to the course of normal music training, study, and research. Curious about this set of value judgements, I came to understand that it was probably the nebulous, subjective, internalizing, ethereal qualities of improvisation which bothered academics the most, and I resolved to solve this problem somehow.

I became interested in statistics, as one method to solve the problem, by way of stochasticism and random distributions. Utilizing various random distribution algorithms in simple compositional automata, I became curious to know if my automata were actually generating the intended random numbers according to the correct distributional curve, or not. One of the ways to prove this is through the use of statistics.

The research scientist's career is spent trying to shape a theory through the testing of various hypotheses. The *null hypothesis* is postulated in order to be rejected using statistics. The word *null* is used, because it indicates no differences between samples being observed. A sample is a collection of numbers from a population of larger numbers being observed. If there are differences between samples under the accepted level of significance (normally .05 or 95%), an *alternative hypothesis* may be accepted instead, which helps shape the theory. Thus the research scientist works from a scientific method which is aimed at establishing the truth through the testing of hypotheses and the shaping of a theory.

An example of an elementary scientific study concerning improvisation might involve a case where a researcher is attempting to ascertain if an audience chooses as more pleasing an improvised performance of bird calls or one involving electric guitars and saxophones. The researcher's theory might simply state: audience members prefer improvised performances of guitars and saxophones to bird calls. Attempting to shape and ultimately prove this theory the researcher would probably begin by utilizing an ordinal scale for feedback through an audience survey card. The card would state: On a scale of 1 - 10 rank the improvised performances you have just heard, with 1 representing the least pleasing choice, and 10 the most pleasing choice. In order not to bias the experiment, the researcher would very likely use a set number or population (say 100 people) from which to draw a sample. Thus the audience population would be the same for both performances, although one group would attend one performance, and the other group the second performance, the performers would be the same for both performances, and every other aspect capable of being controlled in the experiment would be duplicated as well.

In this experiment, the null hypothesis would state: the two samples are from the same population and there will be no difference between the mean scores of audience members who prefer bird calls to guitars and saxophones. A one-tailed, or general, alternative hypothesis would state: the two samples are *not* from the same population and there *will* be a difference between the mean scores of audience members preferring bird calls to guitars and saxophones. A two-tailed, or specific, alternative hypothesis would state: the two samples are *not* from the same population and there *will* be a difference, higher or lower depending upon the bias, of audience members preferring bird calls to guitars and saxophones.

If the researcher is able to prove through statistics, at or over say a 95% (.05) level of significance, that the probability of the difference between the mean scores of audience members preferring guitars and saxophones to bird calls did not take place by chance alone, then the null hypothesis can be rejected and shaping the theory begun by accepting one of the alternative hypotheses.

The following represents hypothetical data from the experiment: (Group 1 is a sample of 25 surveys taken from the guitar and saxophone performance, and Group 2 is a sample of 25 surveys taken from the bird call performance.)

Research Data

	GROUP 1	GROUP2
1	7.000	1.000
2	8.000	4.000
3	10.000	3.000
4	2.000	6.000
5	1.000	2.000
6	6.000	4.000
7	8.000	3.000
8	4.000	1.000
9	3.000	2.000
10	8.000	3.000
11	10.000	1.000
12	9.000	9.000
13	9.000	10.000
14	10.000	8.000
15	7.000	6.000
16	4.000	3.000
17	1.000	5.000
18	8.000	2.000
19	9.000	8.000
20	10.000	9.000
21	5.000	2.000
22	8.000	10.000
23	6.000	1.000
24	2.000	3.000
25	7.000	5.000

```
          Total observations:   25

                       GROUP 1       GROUP2

N of cases                  25           25
Minimum                  1.000        1.000
Maximum                 10.000       10.000
Range                    9.000        9.000
Mean                     6.480        4.440
Variance                 8.677        9.007
Standard dev             2.946        3.001
Std. error               0.589        0.600
Skewness                -0.573        0.622
Kurtosis                -0.925       -0.949
Sum                    162.000      111.000
```

```
                 Independent samples t-test
          Group          N      Mean           SD

            2.000       25       4.440         3.001
            1.000       25       6.480         2.946

     Separate variances t = -2.426 df = 48.0 prob = .019

       Pooled variances t = -2.426 df =   48 prob = .019
```

A typical statistics package on the computer calculates the data and shows the mean, or average, of the ordinal ranking (a scale of 1 - 10) was 4.44 for bird calls (Group 2) and 6.48 for guitars and saxophones (Group 1). Based on the sample taken (25 surveys for each group), the probability of the difference in means is .019, or the researcher can be 98.1% certain that this descriptive statistic did not occur by chance alone. Therefore the null hypothesis can be rejected, and one of the alternative hypothesis may be accepted, helping to further shape the original theory.

A summary of the data might state "there was a significant difference between the preferences for the performances for the audience members who attended the improvised performance with guitars and saxophones compared to the audience members who attended the improvised performance with bird calls."

There are various methods of obtaining data for in experimental research. With an ordinal scale of measurement, for example, the researcher is able to tell which performance the audience surveyed preferred but is unable to tell by *how much* they preferred a particular improvised performance. Other types of measurement are nominal, interval, and ratio. Nominal measurement is used simply for classification (ex., good - bad), interval measurement is based upon a measurable distance between points (ex., pitches C# - Ab), and ratio measurement permits greater than and less than comparisons as well as accurate intervallic measurement based upon a zero starting point. Ratio measurement is usually accomplished with sophisticated measuring devices such as spectrographs, strobe tuners, etc.. Ranked in order from strongest to weakest, the types of measurement are: nominal, ordinal, interval, and ratio.

In addition to the types of measurements used, statistics may be descriptive or inferential statistics. In descriptive statistics certain characteristics about a set of data in concise mathematical form are described. In inferential statistics, inferences concerning large groups are made based upon findings within a smaller representative group or subset of the larger group.

Admittedly, not all aspects of improvisation lend themselves to a thorough experiment involving statistics, yet, a great deal concerning the processes involved in improvisation-- both from the standpoint of the audience and the performer-- remains to be revealed. In *The Musical Mind, The cognitive psychology of music* (Slodboda, 1985), John Slodboda writes about the need to develop protocols for improvisation by playing back an improvisation several times immediately after the performance and asking the performer to recount his experiences. This narrative approach to the improvisational experience, recounted by the performer may aid in nominal terms, and begin to help define in more scientific terms what is taking place in improvisation.

The benefits of experimental research in improvisation include the augmentation of a body of knowledge allowing for greater contributions to the profession, and more effective, economical, and improved techniques for creating and teaching. Not to take anything away from the genius and inner wellspring of inspiration taped by great improvisers, vast improvements in technique may be accomplished more readily thru scientific research utilized in improvisation.

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Music and Fractals

Dr. Jim Hearon

Benoit Mandelrot's book *The Fractal Geometry of Nature* has had a profound influence upon the basic mathematical perceptions which underlie academic disciplines such as mathematics, computer graphics, architecture, art, and music. His work has also stimulated a closer comparison of those disciplines with the mathematical "models" which occur normally in nature. Because music is a "sister" art to mathematics, discussions of fractals will contribute significantly to a deeper understanding of the mathematical, esthetical, and philosophical principles in music which contribute to the recognition of a work as well-balanced, and ordered, intermediate between uniformity and spontaneity.

Ordering the frequency of musical pitch demonstrates immediately the significance of fractal applications in music. Organization of pitch demonstrates especially well in the power density spectrum(loudness versus frequency)(Dodge and Bahn, 1986, pp. 185–196)because frequency of pitch is logarithmic. For example in the equal tempered system, the integer the twelfth root of two is used, raised to a particular power, multiplied by a base frequency, to obtain successive frequencies in a scale. In the following formula(Ex. 1) where i = the integer the twelfth root of two, F = the base frequency, and k = the distance in semitones (beginning with '0'), a chromatic scale of frequencies can easily be generated starting with any given base frequency.

Ex. 1. Formula to Generate Equal Tempered Frequency.

$$\sqrt[12]{2} = i \qquad F_K = F * i^K$$

Similarly the number which is the Nth root of 2, may be changed to any number yielding various micro, and macrotonal scales. Another view of the above formula is to use fractional exponents to achieve the same end (Chowning & Bristow, 1986, pp. 162–163) (Ex. 2).

Ex. 2. Fractional Exponent Formula to Generate Equal Tempered Frequency.

$$N^{\frac{K}{12}} = i \text{ where } F_K = i * F$$

Thus pitch is exponential. The following example demonstrates the formula shown in Ex. 2 above, in order to achieve the correct frequency of a pitch a perfect 5th (seven semitones) above a base frequency.

$$\text{Freq} = C = 261.63\text{hz} \qquad 2^{7/12} = 1.498307$$
$$F_7 = i * F \text{ therefore } G = 392\text{hz}$$

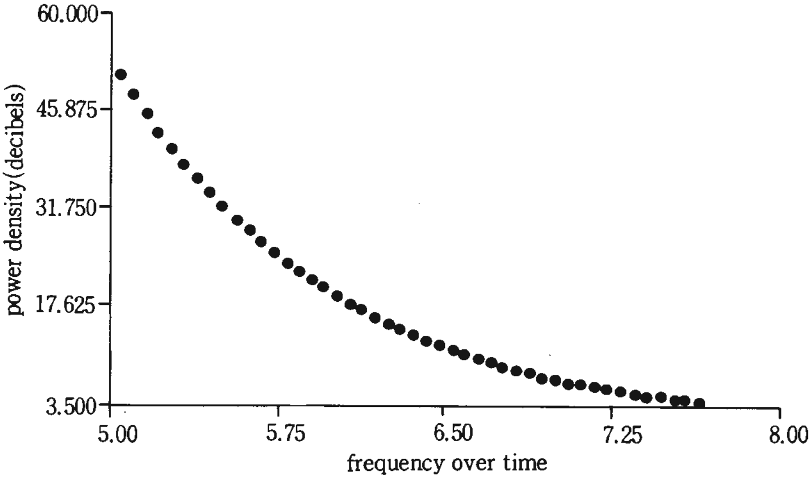
The two formulas are similar in that the number 2, raised to the seventh over twelfth power, for example, is equivalent to the twelfth root of two raised to the seventh power, or the twelfth root of one hundred and twenty eight. The following illustrates this point more clearly.

$$2^{7/12} = 1.498307 = \sqrt[12]{2^7} = \sqrt[12]{128}$$

Since a logarithm represents the exponent to which the number ten must be raised to yield that number (2 is the exponent to which 10 must be raised to yield 100), then frequency of pitch can be expressed as a logarithmic scale using exponents.

Because frequency is inherently logarithmic, musical fractals bear a strong relationship in the presentation of pitch. The 1/f, or "pink noise" power density spectrum is a logarithmic representation of frequency over time versus power density or decibels. The following example shows a logarithmic representation of a four octave chromatic scale with the appropriate 3 db fall off per octave (Moore, 1990, p. 446) (Ex. 3).

Ex. 3. 1/f Power Density Spectrum.



The following brief algorithm in the C language calculates the 3 db per octave fall off appropriate for a 1/f power density spectrum (Ex. 4). "Range" in this case is simply the number of desired frequencies or steps to be returned. For example, the range of a perfect fifth, is seven semitones or steps.

Ex. 4. C Algorithm to Determine 3 db per Octave Fall Off.

```
main()
{
int n, r;
float d, x;
printf (“Enter highest decibel:”) ;
scanf(“%f”, &d) ;
printf (“Enter range:”) ;
scanf (“%d”, &r) ;

printf (“\n%d: %. 4f”, r-(r-1), d) ;
for (n=1; n<=r-1; n++) {
x = (d*. 9438743) ;
if (r>25) {
printf (“%4d: %. 4f”, n+1, x) ;
goto next ;
}
printf (“\n%d: %. 4f”, n+1, x) ;
next :
d=x ;

}

}
```

The number .9438743 used in the above algorithm is the inverse of the twelfth root of two. Hence the db fall off is logarithmic, providing the 1/f spectrum with its shape.

All musical use of pitch approximates the 1/f power density spectrum curve. This fact is demonstrated with the auto correlation formula below (Ex. 5).

Ex. 5. Auto Correlation Formula.

$$A_c(t) = \frac{\sum(P(h)*P(h))}{\sum(P(h)*P(h+t))}$$

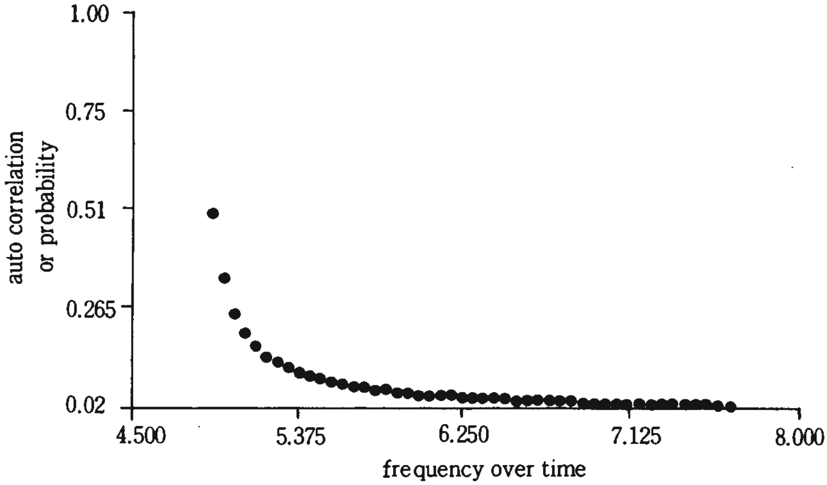
In the above formula Ac = auto correlation, which is a result of time versus probability. The variable t = trial or order, and P = probability event (h). Sigma, $\sum$, is the symbol for the mean. Correlation, more correctly refers to formulas in statistics such as the Pearson product moment correlation and its associated formulas for measuring one set of variables with another. The correlation or probability of any event with itself is 1. Therefore in the Pearson product moment correlation, the correlation of the first event is referred to as "auto correlation, lag 1"(Tuckwell, 1988, p. 93). The above formula however is intended to measure correlation between data of a single variable.

The following set of data shows a group of frequencies and their auto correlation. The pitch frequencies represent four octaves of chromatic scale. The accompanying graph of pitch over time versus auto correlation or probability should be compared with Ex. 3, above for similarity of shape in the power density spectrum curve as it approaches 1/f in the

130.810	1.000
138.590	.501
145.830	.334
155.560	.251
164.810	.201
174.610	.167
185.000	.143
196.000	.126
207.650	.112
220.000	.101
233.080	.091
245.940	.084
261.630	.077
277.180	.072
293.660	.067
311.130	.063
329.630	.059
349.230	.056
369.990	.053
392.000	.051
415.300	.048
440.000	.046
466.160	.044
493.880	.042
523.250	.040
554.370	.039
587.330	.037
622.250	.036
659.260	.035
698.460	.034
739.990	.033
783.990	.032
830.610	.031
880.000	.030
932.330	.029
987.770	.028
1046.500	.027
1108.700	.027
1174.700	.026
1244.500	.025
1318.500	.025
1396.900	.024
1480.000	.024
1568.000	.023
1661.200	.023
1760.000	.022
1864.700	.022
1975.500	.021
2093.000	.021

Example below (Ex. 6). The graph shows the pitch frequencies as logarithms.

Ex. 6. Auto Correlation of Chromatic Scale, Probability Versus Frequency over Time.



Fractal "noises" are classifications of noises whose spectrum diminishes as $1/f^y$, where $0 \leq y \leq 2$. Pink noise represents the case where y = 1, or 1/f noise. In Brownian noise y = 2, $1/f^2$, and in White noise y = 0, $1/f^0$ where the spectral energy is dispersed evenly within the frequency. (Dodge and Bahn, 1986, pp. 187-189). In Brown noise the db fall off is equivalent to 6 db per octave compared to a Pink noise fall off of 3 db per octave. In White noise there is no db fall off.

This means that in White noise there are more "random" or independent frequencies with various levels of loudness, or probability varies greatly in proportion to frequency. In Brown noise there are many more values of smaller probability, at the bottom of the curve, than at the top. Thus small changes in value are more likely than large ones. In Pink noise the degree of randomness is perceived as more natural, where the balance between total chaos and symmetrical constraint allows for just the right amount of spontaneity needed for musical purposes, and the probability is proportional to frequency.

A Fractal equation can also be used to generate random distributions of numbers. The following program in C will calculate a Pink noise distribution of numbers between desired ranges input into the program

Ex. 7. Pink Noise or 1/f Random Distribution Algorithm.

```
#include ⟨time.h⟩/* lib for clock time elapsed since power up */
#include ⟨math.h⟩

main( )  {

int t, 1, h, x, q, u, f ;
double r, max ;
float d, m[500] ;
int rand(void) ; /* correct syntax for rand */

printf (“\t\t\t1/f NOISE DISTRIBUTION”) ;

max = 0x7fff ; /* scales the value of rand to lie 0..1 */

printf (“How many numbers? (500 MAX):”) ;
scanf (“%d”, &t) ;
start :
printf (“\nEnter lowest value:”) ;
scanf (“%d”, &1) ;
printf (“\nEnter highest value:”) ;
scanf (“%d”, &h) ;
printf (“\n”) ;
if (h−1<=1) {/* loop placed here as a precaution */
goto start ;
}

h=h+1; /* highest no. gets plus one */

/* Main 1/f Noise loop */
for (x=1; x<=t;x++) {
next :
srand(clock(  )) ; /* rand is seeded with clock time */
r=rand(  )/max ; /* scales value of ‘r’ to 0..1 */
f=(int) (r*(h-1))+1;
d=d+1+((double)1/(double)f) ; /* double required for float div. */
m[f]=m[f]+1+((double)1/(double)f) ;
q=(int) (((double)m[f]/(double)d)*100) ;
u=(int) (((double)1/(double)f)*100) ;
if (q>=u) {/* loop rejects choices and tries another value of rand */goto
next ;
}
printf (“%4d”, f) ; /* prints numbers */
}
}/* End */
```

To yield a distribution of White noise numbers over the desired ranges substitute the following code in the algorithm given above. The syntax, for the code below shows $1/f^0$.

```
d=d+1+((double)1/pow((double)f, 0)) ; /* double required for float
div. */
m[f]=m[f]+1+((double)1/pow((double) f, 0)) ;
q=(int) (((double)m[f]/(double)d)*100) ;
u=(int) (((double)1/pow((double) f, 0))*100) ;
```

To yield Brown noise distribution of numbers over the desired ranges substitute the following code in the 1/f algorithm given above. The syntax, for the code below shows $1/f^2$.

```
d=d+1+((double)1 / pow ((double) f, 2)) ; /* double required for float div. */
m[f]=m[f]+1+((double)1/pow((double) f, 2)) ;
q=(int) (((double)m[f]/(double)d)*100) ;
u=(int) (((double)1/pow((double)f, 2))*100) ;
```

In the algorithms given above, the simple control loop acts as a filter, where for any random choice of a number between the specified ranges, if the fractional equivalent ('1/f') of the number is less than the number divided by 1+ the fractional equivalent ('d'), that choice is acceptable, else the loop returns control to the point where another random variable is selected between the desired ranges. Thus fractal implies fractional parts of a number. In the algorithms above, the number 100 is simply used as a scaling factor to bring selections within desired ranges. Critical to any use of 'random', is also the need to make certain random is truly random. In this case clock time, or time elapsed since power up, is used to seed random. The following is an example of screen output for the algorithm presented above in Example 7.

Ex. 8. Screen Output for 1/f Algorithm.

```
                         1/F NOISE DISTRIBUTION
How many numbers?  <500 MAX>: 12
Enter lowest value: 1
Enter highest value: 25
  1  1  14  2  3  16  3  16  4  5  5  7
```

Characteristic of a 1/f distribution of numbers, is self-similarity among the elements of the series. Self-similarity includes self-replications at various ratios. The concept of selfsimilarity, integral to the concept of fractals, can be applied successfully to musical rhythm as well as pitch. In a theoretical sense, rhythm is perfectly exponential in terms of its ratios of self-replication. For example, consider a quarter note equals a given positive integer number 'N'. The various rhythmic subdivisions 'R', of the quarter note are all the real numbers which are the subdivisions of the positive integer number 'N'. The various subdivisions of the quarter note are all the real numbers 'R', where: $0<R<N$. Practically however, self-similarity will only approach 1/f, because not every subdivision is useful in a practical musical manner.

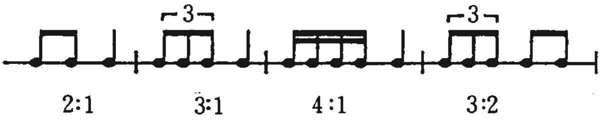
Musical rhythm occurs in one dimensional space, as points along a line. Therefore the fractal or similarity dimension formula given below, is simplified so that the self-similar ratio equals 1, divided by the number N, of self-similar parts.

$$N = 1/r^D$$

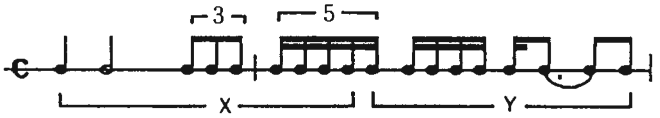
$$\text{where } D = 1$$

$$r = \frac{1}{N}$$

Common rhythmic self-similar ratios such as 2 : 1, 3 : 1, 4 : 1, and 1.5 : 1 (3 : 2) are shown below.



Unlike geometric fractals occurring in Euclidian space, there are no self-affine replications in the rhythmic domain, only self-similar replications because rhythm takes place in one dimensional 'space'. It has already been established above, that the number N is theoretically any positive real number. Hence the ratio ‘r’ can be any positive real number. A comparison of any two rhythmic values X and Y, where X>Y, yields a replication ratio where ‘r’ equals Y/X. It may not be immediately obvious, but in the Example below, the rhythm ‘Y’ is a replication of the rhythm ‘X’ by the ratio .4583.



♩ = N = 480 X = 2304 Y = 1056

r = .4583

While the example above is proof of rhythm’s intrinsic ability to self-replicate, the example will not be perceived immediately as correlated however, due to the uniqueness and isolation of its variables (X and Y). What determines whether more remote replications, such as the example above, are perceived as related, is their frequency of occurrence and order of placement within a series of distribution.

For certain composition and analysis applications the ability to fractally distribute particular values over a specified range is important. This approach is separate and distinct from a fractal distribution between ranges via the fact that only certain values will be included from which random choices will be made based upon a fractal distribution. In a large number of trials, using an algorithm such as the one above in Example 7, particular ranges of numbers invariably occur between the high and low values specified in the input module to the algorithm. In Example 8 above, the screen output shows a distribution of twelve numbers between 1 and 25. Eight discrete values are returned (1, 2, 3, 4, 5, 7, 14 & 16), with four replications in the series, to equal the total distribution of twelve numbers.

Hence more of the numbers in the series are from the ‘low end’ of the range than from the middle or high end. A different approach to fractal distribution using an array structure is given below in Basic, in which particular values are input, then fractally distributed over a specified range.

Ex. 9. Algorithm in Basic Which Fractally Distributes Numbers over a Particular Range.

```
InputMod:
CLEAR
screenwidth=60 : printzone = 6
PRINT : PRINT
PRINT "Enter a total length";
INPUT A
PRINT
PRINT "How many values needed";
INPUT B
DIM Z(B)
FOR C=1 TO B
     Try 2:
PRINT "Enter value no. :"C ;
INPUT Z(C)
    'Trap to catch values larger than total duration
    IF Z(C)>A THEN
    PRINT
    PRINT TAB(5) "(Value larger than total length. Try again.)"
    Z(C) = Z(C-1)
    GOTO Try2
    END IF
NEXT C
PRINT
```

```
PRINT “Here’s the spin:”
FOR C=1 TO B
PRINT Z(C) ;
NEXT C
PRINT
PRINT TAB(15) “(Click Mouse to Continue)”
WHILE MOUSE (0)<>1 : WEND
  ‘Fractally Distributes Array Z elements
FractMod:
CLS
PRINT : PRINT : PRINT
PRINT TAB(15) “FRACTAL DISTRIBUTION OF SPIN”
PRINT : PRINT
DIM M(B)
DIM Y(500)
D = 0
X = 0
V = 0
W = 0
  ‘Lowest value = 1
  ‘Highest value = B
L = 1
H = B
H = H + 1
RANDOMIZE
WHILE V>=0
FOR E = 1 TO B
      Try3:
F = INT(RND*(H−L))+L
D = D + 1 +(1/F)
M(F) = M(F)+1+(1/F)
```

```
Q = INT((M(F)/D)*100)
U = INT((1/F)*100)
IF Q>=U THEN GOTO Try3
WIDTH "SCRN:", screenwidth, printzone
    X = Z(F)
    W = W + X
    V = A - W
    IF V<0 THEN
        WHILE U<20 'Trap to bail out and try distribution again
    W = W - X
    V = A + W
        U = U + 1
    GOTO Try3
        WEND
        PRINT : PRINT "Having trouble completing distribution."
        PRINT "Click Mouse to distribute again."
        WHILE MOUSE (0)<>1 : WEND
        ERASE M
        ERASE Y
        GOTO FractMod
    END IF
PRINT Z(F) ;
IF V = 0 THEN GOTO Last
NEXT E
WEND

      Last:
      PRINT
      PRINT "total = "W"

  Tag:
```

```
PRINT : PRINT
INPUT "distribute (a)gain, start (o)ver, or (q)uit:", Q$
SELECT CASE Q$
CASE " a"
ERASE M
ERASE Y
GOTO FractMod
CASE "O"
CLS
GOTO InputMod
CASE "q"
GOTO Final
CASE ELSE
CLS
GOTO Tag
END SELECT
```

The screen output below, shows the eight discrete values output in Example 7 fractally distributed over a range (duration) of 100. One advantage of using the array approach above (Ex. 9), is that given a particular distribution series, various trials may be made on the numbers of the distribution series to gather statistical data on the correlation between the variables using, for Example, the Pearson product moment correlation mentioned above.

Fractal Distribution

Ex. 10. Screen Output of Algorithm Given in Ex. 9.

```
1  1  4  3  3  3  4  3  1  7  16  3  5  16  2  3  1  16  4  4
total = 100
```

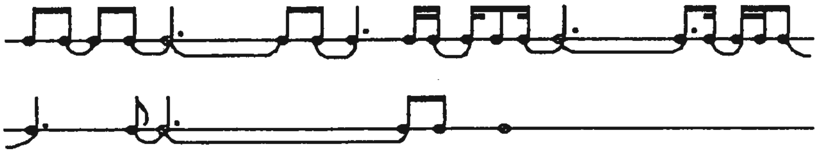
The algorithm given in Example 9 can be utilized very effectively for rhythmic applications. The following example (Ex. 11) shows the screen output, and resulting traditional common practice rhythmic notation (C.P.N.) for a fractally distributed series of rhythms.

```
Enter a total length? 24

How many values needed? 6
Enter value no.: 1 ? .5
Enter value no.: 2 ? 1
Enter value no.: 3 ? 2
Enter value no.: 4 ? 4
Enter value no.: 5 ? .25
Enter value no.: 6 ? .75

.5   1   2   4   .25   .75
```

Fractal Distribution

Ex. 11. Fractally Distributed Rhythmic Series.

```
.5  1  4  2  .25  .5  .5  4  .5  .25  2  4  .5  4
total=24
```

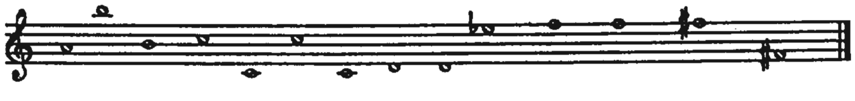


The fractally distributed rhythmic series shown above in C.P.N.(Ex.11), is nonmetered. The example, however, clearly indicates groupings by beat (quarter note). From the algorithm given in Example 9, one is able to calculate a fractal distribution over a specified duration. In the Example given above (Ex. 11), the total duration of the distribution of six basic rhythms is specified as twenty-four quarter notes.

The algorithm given above in Example 7, however, is more effective for generating a series of pitches. Using a numerical series which converts frequency to pitch numbers on the keyboard where middle c = 60 etc., a fractal distribution can easily be written in C. P. N, such as the one given below (Ex. 12).

Ex. 12. Fractal Distribution of Pitches Where Middle C = 60, etc.

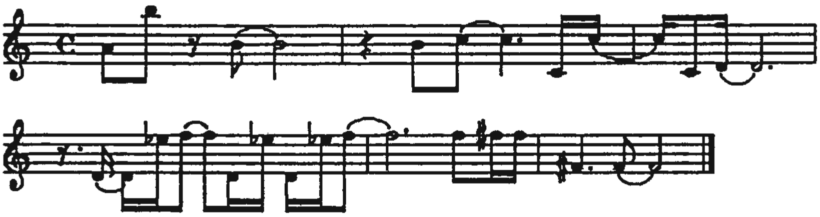
```
How many numbers? (500 MAX): 14
Enter lowest value: 60
Enter highest value: 84
69  83  71  72  60  72  60  62  62  75  77  77  78  66
```



The following example uses the fractal pitch series from Example 12, combined with the fractal rhythmic series from Example 11, and begins to approach a musical melody (Ex. 13). This example also utilizes aspects of serial music, which is to position changes of pitch at the attack points of the rhythmic series. By utilizing additional aspects of serialism, rhythmic durations may be filled with rests, or rhythmic rearticulations of previously sounded pitches etc.

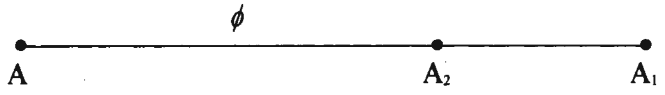
In Example 13 given below an arbitrary meter is selected. Fractal distribtions may be useful, however, for organizing additional dimensions of a musical work, such as meter, form, instrumentation, dynamics, articulation, timbre and texture, which can all be reduced to a series of

Ex. 13. Combined Fractal Pitch and Rhythmic Series.



numbers. For example a fractal distribution of numbers ranging from 1 – 10 could be obtained from the algorithm given in Example 7. Those numbers could then be fractally distributed over a specified duration using the algorithm given in Example 9, and the resulting series used as numerators in a meter signature over a basic subdivision such as the quarter note or eighth note to yield a fractal succession of meter signatures over the specified duration.

One dimension, ordered according to a fractal distribution most often, is form. The Golden Section, or "Divine Proportion", is one type of fractal distribution found in music as well as geometry, architecture, physiology, and many other disciplines. The numerical ratio of the Golden Section is given as Phi(ϕ). The exact value of ϕ is the solution to a quadratic equation derived from points along a line such as the one given below.



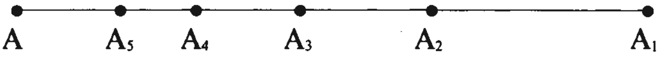
$$\phi = \frac{1 \pm \sqrt{5}}{2}$$

Golden Section = ϕ* distance A to A_1

Thus ϕ has two values: 1.618 and –.618. The negative value is usually discarded because the equation is derived from points along a line where a negative value is considered unacceptable as a distance. However the negative Golden Section is a value which can be retained as useful in a musical context calculating values from the end of a composition or section, termed retrograde or "reverso". The Golden Section is one type of fractal equation which propagates self-similarity. Continuous propagation of the Golden Section takes place when a length is divided by the GS, where the smaller section always has exactly the same length that divides the larger segment by the GS.

The following example shows how the line from A to A_1 can be continuously divided by the GS to yield successively smaller Golden Sections yielding self-similar replications (Example 14).

Ex. 14. Continuous Propagation and Self-similar Replications of the Golden Section.



$$\frac{A_{k\cdots n}}{\phi} = A_{k+1\cdots n} \quad \text{and} \quad \frac{A_{k+1}}{A_k} = \phi$$

A to A_1 = 240(quarter notes)		240/1.618 = @148
A to A_2 = 148	and	240/148.32816 = 1.618
continuous Golden Sections		self-similar replications
A to A_3 = 92	also	A_2 to A_1 = 92
A to A_4 = 57	also	A_3 to A_2 = 57
A to A_5 = 35	also	A_4 to A_3 = 35

In the example above, which is concerned with musical form and not rhythm, fractional parts of measures resulting from dividing by ϕ are rounded to the nearest whole number or beat. Hence divisions of a composition resulting in sections which are organized according to a fractal equation may contribute to the overall musical form.

The fractal equation yields results which are but one type of distribution. Further investigation into the area of randomness, probability, and stochasticism leads to experiments with other continuous and discrete distributions such as gamma, binomial, negative binomial, beta, Cauchy, chi-squared, geometric, exponential, hypergeometric, multinomial, log-normal, normal, Poisson, stable, triangular, uniform, Weibull, linear, hyperbolic cosine, arc sine, Gauss-Laplace, and recursive random functions. Music which is perceived as interesting, vital, spontaneous, well-organized, intricate yet illuminating is imbued with a proper equilibrium between spontaneity and uniformity. 1/f noise provides that natural balance which is intermediate between randomness and predictability (Voss, p. 7).

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〈요 약〉

Music 과 *Fractals*

Dr. Jim Hearon

이 논문에서는 임의 분포류로서의 프랙탈(fractal)에 대한 기본 수학법칙들이 논의되어 있다.

이 분포의 작곡상 활용의 예를 보여 주기 위해 C와 BASIC 컴퓨터 언어에 의한 간단한 컴퓨터 법칙들이 소개되었다. 그리고 프랙탈 분포와 구체적 범위내의 프랙탈적 특정 가치 분포의 가능성에 대한 구별과 작곡상의 유효성에 대해서도 언급되었다.

〈EL〉

Improvised Listening

Jim Hearon

By the age of thirty, the commercial inventor Thomas Edison had developed an impressive research laboratory in Menlo Park, NJ where some of his most significant inventions were born. Outstanding among his many inventions were the incandescent electric lamp, the motion-picture projector, the carbon telephone transmitter, and the phonograph--all inventions that form the basis for modern devices that contribute to the quality, comfort, safety, convenience of our modern lives.

Although the idea for the phonograph had been tinkered with as early as 1857 by the Frenchman Léon Scott, it was Edison, in 1877, who perfected a crude device that could reproduce sounds recorded on a grooved cylinder covered with tin foil rotated by a crank. Sound was recorded on the cylinder by a sharp metal stylus that indented the foil with the vibrations collected from a speaking-tube. As the story goes, Edison astounded himself upon playback by hearing his own words" Mary had a little lamb" that had been spoken and recorded onto the device just moments earlier.

Emile Berliner, a German émigré, first developed the idea of using a lateral recording to reproduce sound vibrations. His device, called the gramophone patented in 1888, used a small lateral disk that revolved at 70 revolutions per minute (rpm). The recorded sound wave forms on the disk had a commercial advantage over the cylinder, because numerous copies could be produced from a master mold. Soon the rpm speed was standardized at 78 revolutions per minute and the disk replaced Edison's cylinder.

The origin of many "modern" recordings comes from the post W.W.II period where the microphone and amplifier had been employed since 1924 to help capture a better quality of sound. In 1948 Columbia Records introduced their new non-breakable vinyl micro groove LP's that rotated at 331/3 rpm. Having developed a better lateral medium, and an improved amplification system, it was not long before the industry turned its attention towards improvement in stereoization of sound where the next revolution was in Hi Fidelity.

With the arrival of compact disk-digital audio (CD-DA) in 1982, traditional vinyl LP's were replaced by the CD as the medium of choice for sound recording. CD's achieve a better quality of sound by utilizing optical technology that includes a laser beam and a photodetector. The photodetector acts as a transducer to convert light signals into electrical pulses. Because sound wave form data is encoded on the CD as a digital sample, the audio quality of the reproduction has been vastly improved over that of the original Lps.

One of the problems associated with repeated listening of a recording, whether LP, tape, or CD is still extant. It has to do with the imagination. Once all of the details of the recording have been ingrained in the imagination from repeated listenings of a recording, boredom sets in. The industry should consider instituting a method of allowing recordings to be played back with some degree of randomness. Since audio production is almost exclusively digital, it would seem reasonable to have the composer or recording engineer include a code at critical junctures in the work that would allow an alternative solution to be rendered upon playback. In other words the playback would reach a point in the recording where it was possible to branch to an alternative solution, either manually or automatically.

This approach would make for more work for the composer or performers, but more enjoyment for the listener. For example after composing a work in the traditional sense, the composer or performers might ask: "how could this phrase have been done differently, and what would be the musical result of that?" Thus a phrase of music might have alternative results associated with it through the branching mechanism of the playback device. Methods of altering branching could allow manufacturers to include keypad devices such as the a symmetrical distribution keypad, the auto program keypad, and the random distribution keypad. The symmetrical distribution buttons might include, for example, such keys as even integers only or odd integers only, or a fibonacci series, or simply a sequence of prime numbers. Auto program keys could allow for favorite playback branching possibilities to be stored in memory. Hence favorite renderings of a recording might be exchanged among audiophiles.

Such an approach to playback is analogous to the kind of excitement a listener has when hearing of piece of music for the first time. It is also like live performance, where the audience has anticipation for the succession of musical events in real time. Recordings of improvised music especially "freeze" the action of real time, and are contrary to the spirit of free improvisation to the extent that repeated successive listenings ultimately lead to boredom.

The mechanism in CD players for locating selections is extremely crude. It consists of a spring loaded electrically moveable sled that manually extends and contracts, or a rotating arm with optical pickup that sweeps across the disk. Both systems operate on the "underside" of the disk. As many as 20,000 different radial tracks may exist on the typical compact disk. Most CD players use a system of reading data through the photodetector from just one laser that is split into three signals to help focus the beam on the given track. Given the relative slowness of the tracking devices for moving the laser to the approximate location on the disk, for random playback possibilities it might be advantageous to use several lasers and photodetectors with signal switching devices attached. In other words instead of just one laser searching the whole disk, perhaps several stationary lasers might be a better approach.

What is being proposed here is pretty radical in terms of the capabilities such a consumer electronic device would afford the listener. In effect each listener, with such a device, becomes a kind of instant composer able to alter the playback of recorded music via the ability to select alternative solutions through the distribution and control of branching capabilities. Radical yes, but wild definitely not! All one has to do is think back to Thomas Edison's original phonograph invention to realize that essentially we've been utilizing the same approach to audio recording and playback for over one hundred years. The time might be ripe for a new listener's revolution.

Practicing Improvisation

Jim Hearon

It seems almost impossible at times to pick up an instrument and "practice." Anything seems like a good excuse to avoid the hum drum rote musical neuromuscular activity commonly known as practicing. This solitary activity is necessary however to remain in touch with and proficient on a musical instrument, including the voice. Most of us liken what we do as musicians to picking up our instruments only for the gig, to rehearse, record, do a sound check, or in the best case scenario...earn a few bucks. Practicing regularly for the purpose of improving individual technique, usually requires playing some mind games.

How does one practice improvisation? Improvisation, after all, should be the goal of good practice. Good improvisation is high art, whereas practicing is a fairly mundane task, and naturally we would prefer to create high art all the time instead of just practicing. More to the point, truly spontaneous improvisation occurs on the spot and does not seem particularly extemporaneous if arrived at by calculating means such as by practicing.

Many good jazz players practice obsessively and are self-conscious about developing a monster technique. John Coltrane was a musician who practiced a lot. When you hear musicians discuss his performances however, it is evident his practicing was a mean to an end. Practicing in the jazz sense can mean exploration. Not exploration to discover new music territory, but exploration of banal tools such as a G major scale in order to discover for oneself all the ramifications on one's instrument of G major. In that sense, technique becomes super technique where the musician is becoming enlightened by the discovery of all the possibilities of G major and working out all the possible solutions to hypothetical situations. Thus spontaneous improvisation then becomes the manipulation and juxtaposition of well-known materials and details in new and suddenly interesting combinations.

The long term aspects of practicing in order to develop techniques do in fact contribute to a gradual artistic development. We may not realize it but when we practice creativity, we are also steadily moving the center of our musical materials that conform to the boundaries of good taste, in the direction of new technical expertise. In this way music that is created by the techniques that were developed for its production gradually changes and becomes not only more accomplished and expressive but also organic and generational where one technique eventually leads to another over a long period of time.

Breaking the activity down into smaller units mentally is another way of looking at practicing. Certainly, as improvisors, practicing for improvement is a good idea, but practicing for consistency is even better. If, for example, you have a work or an idea that you regularly utilize in performance, it is a good idea to keep this music polished and shining, in order to be able to play it on a moment's notice. Work on your repertoire daily, or at least part of it, and if practicing is an odious thought to you, and you would simply rather play; then try thinking of your playing in terms of a warm up period, a time for searching, development and exploration, and a time for cooling down. Seek to focus attention on particular individual aspects of your playing such as tone, vibrato, phrasing, articulation, rhythm, dynamics, tempo, pitch, harmony, or extended techniques for the purpose of allowing those individual units to gradually affect the whole idea of your playing.

Simply practicing is not going to make a career for you as an improvisor, but it can provide some of the self-motivation needed to succeed. When the time comes to audition, perform, or record, a good technique is going to present a better picture of you as a musician. The best way to be in control of your ideas is to work with them regularly.

Suburban Society and Music
or An Encounter With New Age Discrimination

Jim Hearon

Suburban, meaning beyond the city, was an invention of the post WWII era. Some say the suburb first appeared in NY, others in California. In any case, today suburbs sprawl from New York to California, and continue to grow in each of those states and communities, taking more land, encompassing new territory, and eating up everything that gets in the way of progress. Development has been so rapid in some areas, that suburbs as recent as the sixties and seventies have become depressed areas and are now slums. But recent developments, such as those in California, continue to grow and spread with amazing rapidity, where the houses are all alike with only slight variations (two bedroom, three bedroom etc.), prices spiral out of control, and the communities become more remote and more withdrawn and self-contained from the sources of the urban center where many of the suburbanites work.

The houses are built in stages: the same type of construction is accomplished for ten or so homes all at the same time which gives a discount to the developer via the use of subcontractors. Chic now is to build three or four model homes, which are furnished and staffed with sales representatives and ready-made financing available, so that prospective buyers may "choose" the model they wish to have built. The houses are basically all the same. In the Northeast it is the "Saltbox" style, in the South and Midwest the "brick home" with large spacious lawns, in the Southwest the "Adobe" style with tiled roof, and in the West the "Stucco" painted in earthtone pastel colors with shake or composition roof. Of course very unusual, and very pricey, are those non-traditional houses such as a Saltbox built in the middle of a California suburb, or a Southern Mansion complete with non-functioning columns built in a Southwestern neighborhood. Worse are whole communities built on themes such as a hundred Adobe-style homes built in Indiana with a community name like "Buena Vista". Of course it doesn't matter that there really is no "good view" at all. In fact the residents may find they are living over a former land fill, next to property on which a giant shopping mall is scheduled to be built in the near future.

The car culture is another aspect of suburbia. Garages were made for storing boxes, not cars, and so once in a while the boxes with junk in them are hauled out on to the driveway for a ubiquitous "garage sale". As families have moved to the suburbs the freeways have also had a difficult time keeping pace with the increasing traffic, and growing psychological problems encountered from the drivers who are frustrated and stuck in them. The minimum amount of cars per household includes at least one sports utility vehicle (formerly the "truck", now the "Explorer/Land Rover/Ranger" type vehicle), one sleek expensive sedan ("Acura/Lexus" etc.), and that bane of all freeway drivers everywhere the "Minivan". I don't know who invented the concept or the Minivan, but they must have had a sadistic sense of humor, or else not realized that suburban moms from hell would pile the kids in them and drive like NASCAR drivers down the freeway. Of course if you've ever been stuck behind one of these things you know you can't see over, around, or through one of these things, they spew exhaust like crazy, the kids inside them are frequently very distracting because they're always fighting, screaming, and generally throwing things at each other. If you own one they have two speeds: fast and faster. Worse is being stuck in front of one. Seems like the moms are always late and brown nosing right up your bumper, looming large in your rearview mirror, constantly bearing down on you, unkindly suggesting you do whatever it takes to get out of their way, because dammit it's their road, and their lane, and nobody else should be in it.

In California, these newly developed neighborhoods have also become increasingly self contained. The developers charge residents a surcharge for the schools, fire stations, and often police substations which are built within the neighborhoods. Pony fences outline the communities and have gated entrances with security guards. They are frequently nested within other communities, and when there is an "open house" for sales purposes, direction signs are posted on all street corners which read "This Way to Camden Park". (Try following these signs sometime. They usually lead only to a piece of walled property which has been scraped clean by earth moving equipment.)

The people who live in these communities are a different breed of Americans. They have become increasingly conservative, consistent with the type of containment and walled isolationism apparent in their community's construction, and they want to shop, worship, and become educated in the same squeaky-clean type of environments. Nearby shopping centers, for example, feature store fronts with business such as "Manicure and Pedicure", "Holoistic Health", "Packaging and Wrapping", and the ever present Wal Mart Superstore complete with surrounding satellite fast-food restaurants. The churches in the communities are typically grandiose in proportion with styles which reflect the opulance of the community's spiritual and financial well-being. Many residents of these communities are now part of conservative religious movements. Not that religion is necessarily bad, but the people who participate tend to be aggressively vocal and have a way of forcing the surrounding schools to stop celebrating Halloween for instance, and from presenting nativity scenes at Christmas, and will not allow teachers to show anything in class which causes bad dreams or is remotely sexual or unspeakably Darwinian. Everything has become so sanitized. Many of the children are home-schooled and protected from R rated movies, television with violence, and only go to social events with other "safe" children whose parents know each other and can therefore confirm their moral beliefs as "proper". The children will grow up and someday be placed in a position with a bunch of street-wise, hood punks, and will be like lambs led to the slaughter because they don't know or understand anything about what goes on outside their completely homogenized self-contained communities. They just know it's bad.

The music which is popular in their homes, cars, and workplaces is overwhelmingly Country & Western. This makes a lot of sense: People in expensive homes and cars dressing up like a bunch of cowboys and cowgirls, going out to the local "sports bar", ordering non-alcoholic beverages, and doing country line dancing to recorded CDs. If the music is not C & W, then it is usually Rock "Oldies" such as early Rock n' Roll, Surfing Music, and 50's Rock Ballads. There are always those people on the "fringe" who listen to slick fusion Jazz, but they try to keep it a secret, and only tune in while sitting in their cars in the garage making business calls on the car's cell phone while smoking cigars.

Society, like the homes, and music in the suburbs has tended to become increasingly monochromatic as well. Unfortunately living in the suburbs requires that one look like all the other suburbanites, dress like they do, behave, think, relax, and socialize as they do. Otherwise one is different, unusual, draws attention to oneself, and is therefore potentially dangerous. People have become so protective and so concerned about secluding themselves from drugs, sex, violence, child molesters, child abusers, serial murderers, sexual harassment, traffic jams, and bad hair days that a new type of discrimination has begun to emerge from this society. Perhaps because our constitution prevents discrimination based on race, religious beliefs, sexual orientation, or physical handicap, these new types of prejudices and discrimination have started to emerge with increasing harmfulness of effect. I guess people just love to hate each other. What makes it difficult, however, on the small scale, is to understand what is "in" and what is "out". For example drinking White Zinfandel wine is no longer "in" as it used to be just a few months ago.

The children of these parents are really small radars for this kind of thing. For example in the Middle and High Schools one can really see this phenomenon magnified to immense proportions. This week the "in" song is by *Collective Soul.* Next week the "in" song is by the *Smashing Pumpkins.* This week the girls wear purple lip gloss and white pancake makeup and look like vampires, next week it's on to something else. These are simple, and basically harmless manifestations of the deeper more serious games played by adults--and it is usually very serious when it affects one's ability to get or keep a job because the guys at the country club or racquetball court decide they don't like the kind of car you drive or the fact that your wife does not shop and charge as much as their wives do. Pretty soon one is a rebel, an outsider, thinking too creatively, and becoming too independent and very soon on the way "out".

Most of us grew up during the time of the rise of the suburb and a few were lucky enough to be raised in them. I was born in the city, but at an early age moved to the suburbs, and therefore as an adult was seduced into thinking I might be comfortable there once again. Unfortunately it's a different world there now. I've found that I do not fit in at all there now because my beliefs and lifestyle have nothing in common with the people who live in those communities. I remember my family's new Ford "Galaxy 500" during the sixties, and my first neighborhood garage band in the suburbs, in which I was the drummer, touring and playing gigs at ages 12 & 13. I remember listening to "Top 40" radio, also playing Beatles 45 rpms at home, and felt like I was becoming a professional when our band learned "House of the Rising Sun" by the *Animals.* Those were some of the good things. But the suburbs are further away now. They are more expensive, more exlusive, and definately more conservative. It seems like a dream culture: one which exists only for people who have a "dream" home, and "dream" of sucesss, good health, and retirement and will do anything they can to get it and keep it. I look at rows and rows of them in their cars and homes, which are all alike, and I wonder why they are so afraid to think and be creative, real, and independent people. It's sad, but we've lost something very important in our society which has fallen into that immense empty, lifeless void which has become the "suburb".

Take a drive out there some Sunday afternoon. You'll be amazed at what you see.

Tuning and Temperament

James Hearon

The tuning of the Equal tempered diatonic scale based upon 100 cents per semitone, is an adjustment from the natural or acoustical ratios which form intervals in the overtone series. The various compromises to tuning contained within the modern 12-tone Equal tempered scale are nevertheless differences to which we have become accustomed to, based upon the familiarity with the tuning of the modern piano. In instrumental and choral ensembles of mixed instruments and voices playing together without the foundation tuning support of the piano, alternations and adjustments to the 12-tone Equal tempered tuning are often desirable in order to affect the overall quality of an ensemble's melodic and harmonic intonation.

Pythagorean tuning, believed to have been discovered by the Greek theorist Pythagoras c. 550 B.C., (Apel 1979, 709) was based upon the division of the octave into intervals which could be expressed in terms of harmonic ratios based upon the perfect fifth. Pythagoras found that musical intervals could be expressed as ratios which represented divisions of the string on the monochord, an ancient Greek single-string instrument. The string divided in half, yielded a pitch one octave higher than the open string and could be expressed by the ratio 2:1. The ratio of 3 parts to 2 parts (3:2) yielded a perfect fifth in Pythagorean tuning and all the other musical intervals as well, could be expressed as a product of this basic ratio. For example the major second interval (9:8) could be expressed as $[(3:2)^2] * 1/2 = 9:8$ (Fig. 1), or the projection of two perfect fifths divided by one octave yielded the major second C - D (do - re).

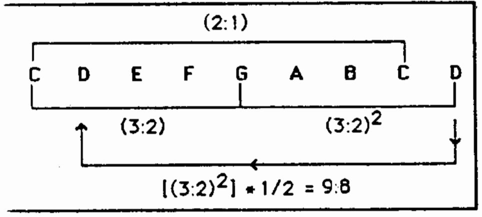

Fig. 1. Projection of two Pythagorean fifths, reduced by one octave to yield the harmonic ratio of a diatonic major second.

The following chart (Fig. 2) represents the arrangement of intervals,in Pythagorean intonation, based upon a projection of perfect fifths (3:2), in the major scale for the intervals above a tonic.

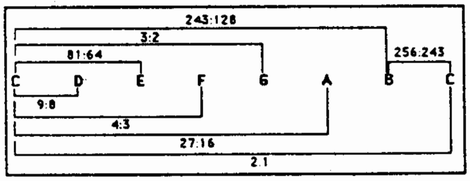

Fig. 2. Harmonic ratios of diatonic intervals in a Pythagorean major scale.

The ratios for the Pythagorean intervals, in addition to representing divisions of a string, also represent harmonic partials in the overtone series. When the perfect fifth interval is tuned to represent the natural or acoustic perfect fifth, Pythagorean intonation is being employed. While tuning for the slightly larger acoustic fifth improves intonation appreciably in isolated musical passages, consistent use of the natural fifth (3:2) causes sharp intonation in remote keys.

Because the natural or acoustic perfect fifth (3:2) is larger than the modern tempered fifth (700 cents compared with 702 cents), an error results when the natural acoustic fifths are projected from the pitch C over seven octaves to include all the tones of the chromatic scale (C-G -D-A-E-B-F#-C#-G#-D#-A#-E#-B#). The difference between the ratio of the final B# [(3:2) raised to the 12th power] and the octave of the fundamental (C) transposed seven octaves [(2:1) raised to the 7th power] is called the Pythagorean Comma and is equivalent to 23.5 cents (129.74634:128 = 1.013464:1 or 23.5 cents) (Dodge & Jerse 1985, 43). Thus the ratio above of B# is slightly higher or sharp to the ratio of C which equals: $(2:1)^7 = 128$.

This and other problems, such as the large ratio of the major third, do:mi (81:64) which should be the more natural ratio 5:4, and the small half-step, mi:fa or ti:do (265:243), which should be 16:15, as well as problems with the major sixth, minor third, and major seventh, clearly indicate that the Pythagorean scale contains anomalies of tuning. The scale is not a perfect one, but aspects of Pythagorean intonation are often still used today. For example string players tend to squeeze the half steps or semitones closer together, especially in sharp keys, thus approximating the small Pythagorean semitone (256:243). In the tuning of brass chords many conductors base the relative intonation of a particular harmony on the open fifth tuning, thus yielding the natural or acoustic fifth (3:2). Also choirs use the big major third (81:64) from Pythagorean intonation in both melodic and harmonic intervals. (Backus 1977, 150) Adjustments must be made, however, when incorporating Pythagorean intonation into performance practice where the ensemble employs a piano which is tuned to 12-tone Equal temperament.

The Just intonation Scale, mentioned as early as 1588 in Gioseffo Zarlino's *Sopplimenti Musicali*, was an early attempt to solve some of the problems associated with Pythagorean Intonation. The Just Scale uses a small whole tone (10/9), in addition to the large whole tone (9/8), to form the diatonic major scale. Thus a new slightly larger semitone came about which was based on the harmonic ratio 16/15.

The arrangement of major and minor 2nd intervals in the major scale allowed for a more acoustically correct major 3rd. which was the ratio 5/4, the 'pure' third, (9/8 X 10/9 = 90/72 = 5/4). The following chart (Fig. 3) represents the arrangement of intervals above a tonic in the major scale based upon the harmonic ratios of Just Intonation.

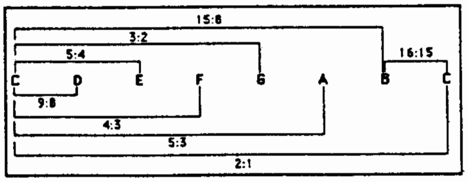

Fig. 3. Harmonic ratios of diatonic intervals in a Just major scale.

Although the Just scale contains the smaller, more acoustically correct major 3rd. (5/4), the larger semitone (16/15), and a more acceptable ratio of the major 6th. and major 7th., problems still arise with tuning in this scale from the use of the two different ratios for the major 2nd. (9/8 and 10/9). For example the ratio of the perfect 5th. from C to G (do/sol) is 3/2, the acoustically preferred interval. However the ratio of the perfect 5th from D to A (re/la) is 40/27 (10/6 X 8/9 = 40/27)[1], (Fig. 4).

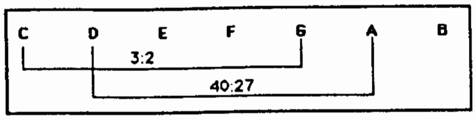

Fig. 4. Harmonic ratios of two contrasting perfect fifths in a Just major scale.

While the Just scale allows for more pleasing harmonies than the Pythagorean scale, especially in the construction of pure triads which contain the large natural perfect 5th. (3/2) and the smaller major 3rd. (5/4), tuning problems result from the use of certain intervals within the scale and also when the scale is used as a mode (Dorian, for ex.). (Rigden 1977, 207)

Pietro Aaron (c. 1490-1545) was one of the first theorists to explain Meantone intonation in his *Thoscanello de la Musica*, 1523. (Apel 1989, 835) Meantone tuning was widely used for several centuries and continued in organ building well into the 19th century. This tuning was an attempt to reach a compromise between the anomalies of Pythagorean and Just intonations. In Meantone tuning, scale tones come about by a projection of fifths in which each fifth (3/2) is consistently lowered by around 5 cents (yielding a ratio of 1.49533) around the circle of fifths. The 3/2 perfect fifths of Meantone intonation contain 696.6 cents compared to the 702 cents of the Pythagorean fifth which is also 3/2. (Partch 1979, 410)

Since each third in Meantone corresponds to a projection of five fifths (C-G-D-A-E), the value of each fifth is the 4th root of 5 (1.49533). Each fifth upward is 1:4th root of 5, with successive fifths expressed as powers of that expression. Each fifth downward is simply expressed as the 4th root of 5 (to bring the intervals within one octave, multiply or divide the expression by the number of octaves distant from the fundamental). The following intervals above a tonic are found in the Meantone major scale (Fig. 5), (Levarie 1980, 229-230) .

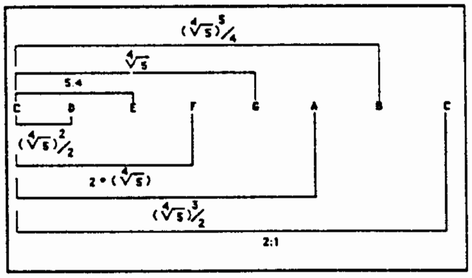

Fig. 5. Harmonic ratios of diatonic intervals in a Meantone major scale (1/4-comma tuning).

In Meantone tuning the idea was that the error of the comma produced by the large fifth could be solved by projecting five fifths (each flattened 1/4 Syntonic Comma c. 22 cents) and transposing down two octaves to yield a pure third of 5:4. 1/4-comma temperament, however, is just one approach to Meantone tuning. Alternate systems of Meantone tuning, some of which are less systematic, temper intervals based upon the selection of a predetermined complete cycle such as the circle of fifths, fourths, or a sequence of 3 major thirds to yield a pure octave, or 4 minor thirds etc. The 1/4-comma tuning produces satisfactory 'pure' triads (4:5:6: or 4:4, 5:4, and 6:4 which equals 1:1, 5:4, and 3:2 or unis., major 3rd, and perfect 5th). The continuation, however, of a projection of flattened fifths causes noticeable differences between sharp and flat tones, especially starting with G# and Ab where the difference at that point is almost a quarter tone (42 cents), called the 'wolf' tone. (Apel 1979, 835) The wolf tone can be shifted by employing various shadings of Meantone tuning based upon a different cycle.

(Continued page 32)

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[1] To add ratios (intervals), multiply. For ex. C-F + F-G = 4/3 X 9/8 = 36/24 = 3:2. To subtract intervals, invert (the smaller interval) and multiply. For ex. C-G - C-F = 3/2 X 3/4 = 9:8.

Successful Practice

Philip T. Cansler

Musicians are always looking for the magic secret of playing an instrument. Unfortunately there isn't one. It takes many hours of hard work, but more importantly, it's necessary to practice the right way. Organization of the practice period is important so that all materials are covered daily. Self-discipline and dedication to practice are essential qualities of a successful musician.

Always keep in mind that practicing has an ultimate objective: the ability to perform a composition and to convince the audience of the work's characteristics and the performer's interpretation of them. Whatever is accomplished in the practice room is taken on stage to offer the audience. Good practice methods mean fine performances will follow.

Some of the objectives of practicing include developing a positive self-image with the security and self-confidence that each performance will go well. The central issue in practicing is concentration—not the ability to concentrate— but rather what is concentrated upon: Where the attention is being directed. In performance, all concentration should ideally be on the form and aesthetic of the piece being performed. Any attention to (or worry concerning) technical problems in performance means that total concentration is not on making music. After all, the reason for performance is to create music, not to survive difficulties. Good practicing is a process of solving problems methodically so that these areas do not dominate the performer's attention. The best practice methods integrate the problems of technical mastery with the demands of successful performance. It is actually the mind which plays the instrument and makes the music. It is the musician's mind which the audience hears. Practicing involves disciplining the mind, making it function correctly and dependably which develops security and self-confidence. Good practicing must be based on success and accomplishment. To believe that success is possible you must solve problems every day. Practicing is a careful, deliberate process of building ability. The only material at the player's disposal in creating music is tone. Factors such as rhythm, pitch, vibrato and dynamics merely modify the tone. But it is the player's tone that the audience hears. Do not play rhythms with the tone; instead, use rhythms to organize and give form to your tone. Likewise, vibrato merely colors the tone. Always produce the best, most beautiful, basic tone that is possible.

At all times be alert and sensitive to correct pitch and correct rhythm. There can be no compromise, no "almost right." This involves total concentration. If the mind is wandering while playing do not call it "practicing." It is essential for mental and physical processes to receive rests during the practice session. If the muscles are weakening or the mind begins to wander, take a short break. A good musician plays well any time, not just on special occasions. After the music is learned it is important to practice the performance. The musician should visualize the entire concert situation, then play the complete performance in the practice room. With experience the practice session and the concert become very similar and if a mistake does occur, the continuity of the music can remain intact. Many anxieties can be alleviated before performances by taking deep breaths with extended exhales which slow the heart beat and allow a relaxed, concentrated mind to dominate the performance.

Remember, the only person who can teach you to play is YOU. No teacher can make a performer out of you. Music development is an individual art with guidance from a teacher. So, approach music with intelligence, self-discipline, and determined optimism. Successful practicing provides a clear and open channel so that artistic expression can reach the world. Do not deprive us of what YOU have to offer. W

(Settle from page 31)

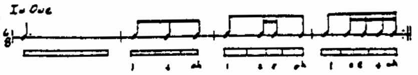
Advanced Level

The geometric approach at the advanced level should include simple meter exercises as well as compounded meter exercises. While the circle is effective for teaching simple meters, it is more practical to use the rectangle when counting in compound meters such as 3/8, 6/8, 9/8, etc.

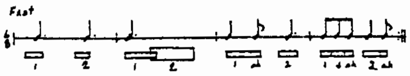
The student should be taught that 3/8, 6/8, 9/8 meter rhythms are based primarily on the triple figure. In other words, there are three pulsations in every rectangle figure▭,with each pulsation receiving one-third of a count. Realizing that a complete rectangle represents one full count, the student should grasp this concept as easily as he did the circle figure.

The following examples demonstrate the use of rectangles in teaching rhythms:

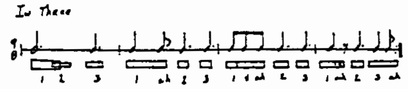
Example 7:



Example 8:



Example 9:



Conclusion

The perspective of the geometric approach has been cast to respond to the rapid and transmutative conditions of today;s demands on the music educator. This method is not very time consuming for the teacher or the student. The author has found that the geometric approach to rhythm counting, when compared with the traditional method, is an overall easier method for the student to learn. It is reinforced daily through the arithmetic class, and is uncomplicated and confidence building. The traditional method of teaching music will always remain an integral part of music education, but, as responsible and innovative music educators, we must provide techniques and teaching experiences that will result in successfully organized methods of learning. The longevity of an effective instrumental or vocal program in the public schools will be dependent upon the quality of music reading in the background of the young musician.

(Hearon from page 29)

Still other approaches to temperament include 12-tone Equal temperament which also represents an adjustment to the natural or acoustic intervals of the overtone series. In 12-tone Equal tuning, the cents value is the basic unit of measurement, and all semitones equal 100 cents. Compared to the most common ratios representing some of the diatonic intervals from the overtone series, Equal temperament contains a flat fifth, a sharp fourth, a sharp major third, a flat minor third, a sharp major sixth, and a flat minor sixth. Nevertheless we have become accustomed to these adjustments in intonation based upon a history of performance with modern piano tuning.

The various approaches to temperament permit instruments which cannot change tuning readily, such as keyboard instruments, to employ a more euphonious tuning which characteristically strives to eliminate the phenomenon of beating in the use of chords. However modulation to distant keys has remained the principal obstacle to the discovery of the perfect natural intonation. Concerning instruments whose overtone partials include inharmonic partials, such as certain pitched percusssion instruments (chimes, xylophone, marimba etc.), adjustments in temperament to achieve 'pure' intonation in consonant intervals does not yield a substantial difference in timbre over consonant intervals which are slightly 'impure', because of the inharmonic (noise) content of the instrumental timbre. (Lindley 1980 Vol. 18, 661) Instruments which can change intonation suddenly, such as the voice and non-fretted string instruments, need not be concerned with definitive tuning systems since various instantaneous adjustments to intonation are generally required throughout a given piece of music. The voice, for example, may be required to use aspects of several intonations (5:4 thirds, 3:2 fifths, 4:5:6 triads, etc.) during the course of a performance in order to achieve the overall effect of good intonation.

Continued developments in the technology of adjustable tuners and the manufacturing of instruments which are capable of changing tunings will soon allow for the possibility of performing in a dynamic tuning environment where temperaments may be changed in succession or in polyphony. The musical ear, considerations of style, the historical context of the music, and good artistic judgement, however, remain the best resources for determining when and where to make the best use of tempered intonation in music performance.

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W

A Method for Creating Varied Symmetrical Harmonies

Jim Hearon

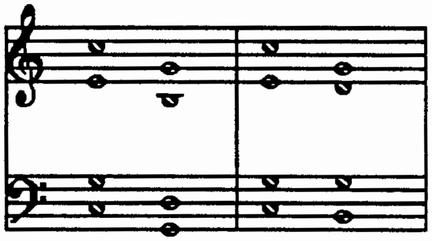
This brief article outlines a method for creating variation within the pitch and interval content of harmonies derived from symmetrical series. In developing automata for composition, some means of generating a rich resource for varied harmony is usually desired. This article puts forth a simple method for creating varied harmonies, and demonstrates the musical results of this method by way of comparison, examples, explanation, and ideas for further development of harmony in musical composition.

The generation of complex harmony can be accomplished through various means. random distributions such as fractal, random, exponential, and logistic distributions etc., are useful to help provide a broad range of varied intervals in the composition of complex harmony. Symmetrical harmonies, however, require the utilization of some type of method in order to generate varied intervals and chord members.

Of the many symmetrical cycles in music, regarding the development of complex harmony in the modern equal tempered tuning system, several cycles can be viewed in terms of their projection of intervals. An example of the best known (and perhaps oldest) cycle would be the Pythagorean projection of perfect 5ths which was used in order to derive the tuning of the Pythagorean major scale. A sequence of twelve projected perfect 5ths, in the modern equal tempered tuning system, over seven octaves results in a complete cycle by perfect 5ths (7 semitones). Other well known sequences for the symmetrical projection of intervals are the the minor 2nd (chromatic scale), major 2nd (whole tone scale), minor 3rd (diminished seventh chord), major 3rd (augmented triad), and perfect 4th (quartal harmony). Sixths and sevenths can be seen as inversions of their complementary projections (seconds= sevenths etc.).

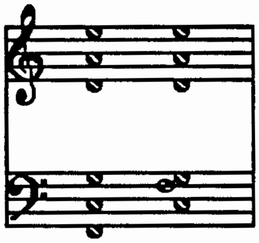
Symmetrical scales may also be used as a resource for developing complex symmetrical harmony such as the whole tone (major 2nd), and diminished or octatonic scale (major 2nd, minor 2nd). Many commonly used scales respect the supremacy of the octave, and duplicate the initial pitch an octave high (or lower), thus the use of common scales (major, minor, modal, pentatonic, etc.) projected over more than one octave could also be viewed as resources for the symmetrical construction of harmony as well.

When compared to its simple or root position (ex. 1), a chord in inversion represents the traditional treatment resulting in varied interval content in the construction of the harmony. Yet inversion, in the diatonic and extended chromatic harmonic context, was utilized chiefly to affect linear variation in the smooth voice leading, and also provide more freedom in the horizontal movement of the bass line within a strict harmonic style which avoided parallel 5ths and octaves.



(ex. 1, C Major: tonic to dominant in root position with parallel octaves and fifths, and tonic to dominant in the first inversion avoiding parallel octaves and fifths)

When using chords constructed symmetrically, there is no variation in the movement of the bass where harmonies of the same symmetry are joined in progression (ex. 2). Another method for developing varied interval content within the symmetrical harmonies must be employed.



(ex. 2, pitch 'F' is transposed, and bass movement remains by perfect 5th)

To achieve a symmetrically constructed harmony a short algorithm is used which specifies a range of pitches from which the harmony is to be constructed (ex. 3). The range is then divided into the proper sequence of intervals (measured in semitones) and the chord is calculated based on the desired symmetry.

Variation of the interval content of the symmetrically constructed chord is achieved by a scaling factor which expands the original pitch range multiplied by the scaling factor. The projected symmetry continues to be calculated through the expanded range providing multiples of the "fundamental" pitches of the basic range. These additional pitches from the sequence are then redistributed back into the range of the basic sequence based upon a random selection of a modulus of those pitches somewhere between the lowest and highest pitches of the initial range. New intervals are then formed within the symmetrically constructed chord based upon the random modularization of pitches projected by the scaling factor. This particular example utilizes a simple random distribution, but any random distribution such as one of those mentioned above would work as well.

```
FOR Y%=LP TO NP STEP 7    [counts by
     7=perf. 5th.  LP=lowest pitch,
     HP=highest pitch, and NP=new high
     pitch (HP * a scaling factor)].
     IF Y%>HP THEN
     B%=Y%
               CheckIT:
               O=R-INT(R)
               F=INT(O*(HP-LP))+LP
               R=(O+3.14159)^3.333
               IF F<LP GOTO CheckIT
               IF F>HP GOTO CheckIT
     B%=B%MOD(F)+LP
     IF B%>HP GOTO CheckIT:
     Z(G%)=B%  (Z is an array)
     GOTO Skip
     END IF
Z(G%)=Y%
Skip:
     IF Y%=NP GOTO OutLoop
     G%=G%+1
NEXT Y%
OutLoop:
```

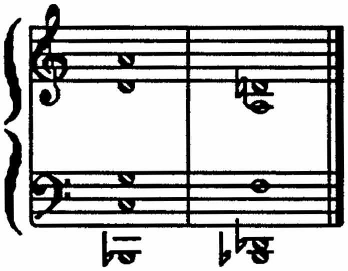
(ex. 3, random modularization and redistribution of projected 5ths)

If pitches for the particular harmony are selected randomly from an array, some type of sorting routine might be convenient to help rearrange the pitches from lowest to highest or vice versa. The routine below uses "while" as a control statement to sort the elements of array Z which is of length X+1 (ex. 4).

```
   Loop3:
    WHILE Y%< X+1
      WHILE Z(Y%)>Z(Y%+1)
         Z(X+1)=Z(Y%)
          FOR B%=Y%+1 TO X+1
             Z(B%-1)=Z(B%)
           NEXT B%
         GOTO Loop3
        WEND
        Y%=Y%+1
WEND
```

(ex. 4, sorting routine to arrange pitches from lowest to highest)

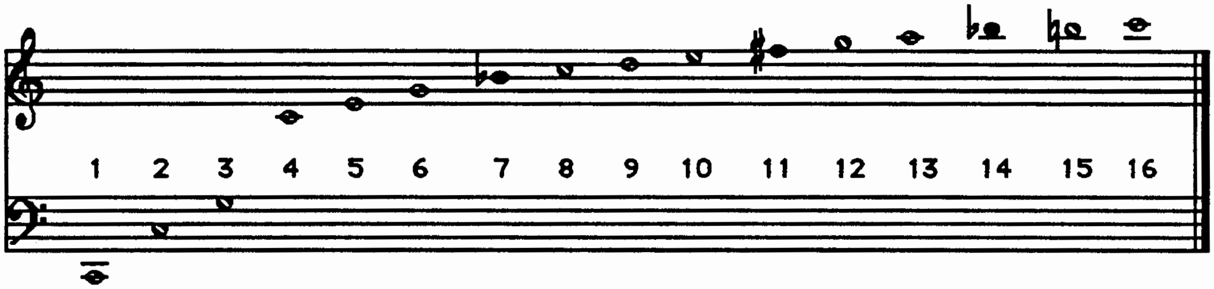
A run of the complete program containing versions of the code listed above produces the two chords shown below (ex. 5). The randomly selected pitches from a sequence of perfect 5ths are (pitch numbers based on middle 'C'=60): 34,48,55,62, & 69 all integrals by 7 or perfect 5ths from the lowest pitch(34), and 34,37,53,57 & 62 showing varied interval content in the chord constructed symmetrically.



(ex. 5, chord from a sequence of fifths selected randomly, and a chord from a sequence of fifths showing varied interval content thru random modularization of projected fifths)

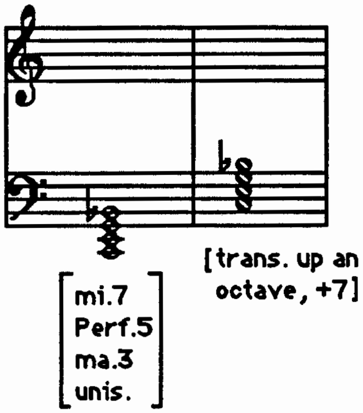
The procedure of redistributing a member of the projected sequence back into the orginal range, based upon a modulo of one of the members of the original range is somewhat analgous to the way chromatic harmonies were occassionally rationalized as being derived from the harmonic series (ex. 6).

John Phillipe Rameau (1683-1764), for example, theorized the existence of the major/minor seventh, or dominant seventh chord was explained by partials 1,3,5, & 7 from the Harmonic Series. In terms of intervals above the fundamental, these pitches would actually be: unison, perfect 12th, major 17th, and minor 21st. To place the pitches all within the range of a single octave and stack the chord members by thirds in root position the compound intervals from above modulo 7 become: unison, perfect 5th, major 3rd, and minor 7th (ex. 7). Another way of completing the procedure is to use semitones and pitch class numbers where the fundamental = 0 and octave duplications of the fundamental, modulo 12, are always equal to "0". Therefore partials 1,3,5, & 7, actually contain semitones 0,19,28, & 34. but modulo 12, the pitch classes become 0, 7, 4, & 10, which are the intervals needed to complete the dominant seventh chord.



(ex. 6, Sixteen partials from the Harmonic Series. Fundamental pitch is "1", Great C)

Transposition can be seen to be accomplished by reducing (dividing by modulo 7) the compound intervals within one octave and then adding 7, the modulus for one octave, to all the intervals (ex. 7).



(ex. 7, major/minor or dominant seventh chord)

There are many examples of this procedure throughout the works of several theorists and composers used to justify the existence of particular harmonies and sequences or series. The work of Paul Hindemith (1895-1963), and his concept of Series 1 and Series 2 from the *Craft of Musical Composition*, and Arnold Schoenberg (1874-1951) and the development of twelve-tone rows, are two examples which help support the concept of the development and redistribution of series.

This method of developing variation within the interval content of symmetrical harmonies proposed here is simple and straightforward. Variation of interval content of symmetrical harmonies could be achieved through any number of different means. The importance of symmetrical harmonies, however, should not be overlooked as a rich compositional resource simply because of their intrinsic properties for duplicating pitch and interval content upon further projection into the pitch continuum, but rather should be seen as a rich resource for potential variation from those elements which remain constant.